DEPARTMENT OF AGRICULTURE
CANADA

ANNUAL REPORT

OF THE

FOREST INSECT AND DISEASE SURVEY

FOREST BIOLOGY DIVISION
SCIENCE SERVICE

1956

Published by Authority of the Rt. Hon. James G. GARDINER, Minister of Agriculture
Ottawa, Canada

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FOREWORD

Organizational and staff changes in the Forest Insect and Disease Survey during 1956 were limited. A few changes in senior staff are of interest and merit recording. The services of both Dr. D. A. Quirke and H. H. V. Hord were lost to the Ontario Forest Disease Survey. Their duties have, in part, been assumed by Mr. J. Reid. A marked reduction in disease survey activities was required and will be apparent to readers of this section of the Report. The Maritime Forest Insect Survey obtained the services of Dr. D. C. Eidt who assumed responsibility for certain phases of the laboratory program at Fredericton. Increases in the field and laboratory staff of the Corner Brook Laboratory are reflected in the section dealing with insect conditions in Newfoundland that forms a part of the report for the Atlantic Provinces.

Facilities and equipment have reached an adequate level in most regions and few noteworthy additions were made in 1956. Field accommodation was obtained in the Meadow Lake Ranger district of northern Saskatchewan. An insectary at the Quebec Laboratory and a 20-car garage at the Fredericton Laboratory have recently been completed.

Survey arrangements in the Province of Quebec remained the same as in 1955. The Provincial Bureau of Entomology conducted a general province-wide survey while the Forest Biology Division was concerned only with surveys of insects of special interest to the research program of the Quebec Laboratory. Only the results of the divisional program are contained in this Report.

A significant extension of the usual coverage of the Survey was made in 1956. Nearly 3000 miles of water travel was logged on the rivers and lakes of northern Alberta and the Northwest Territories. The route travelled extended as far north as Aklavik, N.W.T. The prime purpose of this survey was to follow the extensive spruce budworm outbreak along the Mackenzie River. It also provided an excellent opportunity to assess the insect and disease conditions in the forest stands of these northern areas.

From a national point of view, the spruce budworm and larch sawfly remained the principal forest insect problems in 1956. These problems are dealt with in greater detail in the individual reports which follow and only a general summary appears below.

Spruce budworm outbreaks in the Atlantic Provinces showed a variety of conditions and changes. Striking reductions occurred in Newfoundland and variable conditions were noted in Nova Scotia and Prince Edward Island where outbreaks had occurred previously. The large-scale outbreak in northern New Brunswick and the Gaspe Peninsula area of Quebec continued unabated and even extended its boundaries farther to the south and east. In some areas considerable numbers of dead and dying trees became apparent in 1956. The outbreak that has been of long standing in northwestern Ontario and more recently has invaded southeastern Manitoba showed a number of changes in 1956. Extensive mortality in the central part of the outbreak area was accompanied by a decline in budworm numbers. This was offset by extensions farther eastward in Ontario and westward in Manitoba as far as the inter-lake area. The Mackenzie River outbreak continued in 1956 as a series of small outbreak areas of varying intensity and history extending along the river for nearly 500 miles. Outbreaks of the 2-year cycle budworm could be more critically assessed in 1956, a flight year. Scattered, small patches of defoliation persisted in the Yoho, Kootenay, and Banff national parks. Only light defoliation was recorded in the Pine Pass area north of Prince George in British Columbia. In contrast, near complete defoliation

was common farther west in the Babine Lake area. The outbreak of the 1-year cycle budworm in the Vancouver District of British Columbia declined further, reducing the possibility of extensive tree mortality.

Outbreaks of the larch sawfly were again reported from Newfoundland to Alberta. In Newfoundland outbreaks continued, but showed definite signs of decline. No further increases were observed in the Maritime Provinces in 1956 where several colonies were collected in 1955 after a long period of absence. The larch sawfly remained common in central Canada; population levels in northern Ontario, Manitoba, and parts of Saskatchewan remained low. Severe damage or increased numbers were only noted in central Ontario and northern Saskatchewan to the east and west of this large outbreak area. In Alberta no signs of abatement were noted and conditions remained virtually the same as in 1955. Only one colony was observed in the Prince George district of British Columbia.

A few of the more significant highlights of insect conditions in 1956 were:—the continued spread of the balsam woolly aphid in Newfoundland; an outbreak of the white-marked tussock moth in Nova Scotia; additional pine root-collar weevil infestations in Ontario; marked increases in jack-pine budworm population levels in southeastern Manitoba; and the black-headed budworm infestation in north Vancouver Island. These and many other conditions are treated in greater detail in the following pages.

Forest Disease Survey reports emphasize the unusual weather conditions of 1956. Ice storms in the Maritime Provinces during January caused a great deal of direct damage and set the stage for the entrance of decay organisms. The late, cold spring in eastern Canada caused frost damage to buds and winter drying of foliage. The cool, damp summer that followed favored foliage diseases. In British Columbia somewhat different but equally unusual weather conditions prevailed. The winter 1955-56 came very early and was unusually severe. Some of the more obvious results were extensive winter killing of yellow pine foliage in southern British Columbia, and the death of many ornamental and exotic trees on Vancouver Island and the lower mainland. Summer conditions during 1956 were such that foliage diseases were not in evidence. A marked increase in a dieback condition of Douglas fir on south Vancouver Island has attracted considerable attention and appears to be of some importance.

During recent years less emphasis has been placed in this Report on the tabulation of persons who have submitted insect or disease collections. These lists have been discontinued and do not appear in this Report. Cooperator collections form a valuable addition to those made by Forest Biology Division staff and represent the efforts and interest of nearly 2000 persons each year. These collections are acknowledged directly and in most regions are listed in considerable detail in monthly or periodic summary statements circulated to interested parties during the field season, and it was considered somewhat redundant and costly to include even abbreviated lists in this Report.

Survey officers continued to publish a number of technical contributions in addition to the numerous reports that are prepared. Those which appeared or were accepted for publication during 1956 are as follows:

Carroll, W. J.—History of the hemlock looper, *Lambdina fiscellaria* (Guen.), in Newfoundland, and notes on its biology. Can. Ent. 88: 587-599, 1956.

Condrashoff, S. F.—Advance of the Satin Moth, *Stilpnotia salicis* (L.), into the Interior of British Columbia. Proc. B.C., Ent. Soc. in press.

Evans, D.—A revision of the genus *Poecilonota* in America north of Mexico (Coleoptera: Buprestidae). Ann. Ent. Soc. Amer. in press.

Grant, J.—Notes on a variety of the Western Tent Caterpillar, *Malacosoma pluviale* (Dyar). Proc. B.C. Ent. Soc. in press.

Martin, J. L.—The bionomics of the aspen blotch miner, *Lithocolletis salicifoliella* Cham. Can. Ent. 88: 155-168. 1956.

Reeks, W. A.—Sequential sampling for larvae of the winter moth, *Operophtera brumata* (Linn.). Can. Ent. 88: 241-246. 1956.

Reeks, W. A. and C. C. Smith.—The satin moth, *Stilpnotia salicis* (L.), in the Maritime Provinces and observations on its control by parasites and spraying. Can. Ent. 88: 565-579. 1956.

Ross, D. A. and D. Evans.—Annotated list of forest insects of British Columbia. Part V—*Dioryctria* spp. (Pyralidae). Proc. B.C. Ent. Soc. in press.

Taylor, D. W. and J. A. Chapman.—Flexible cable for foot control of microscope focus. Can. Ent. 88: 258-260. 1956.

Watson, W. Y.—A description of the immature stages of *Lithocolletis salicifoliella* Cham. Can. Ent. 88: 168-177. 1956.

Wong, H. R.—Preliminary notes on intersexes and gynandromorphs of the larch sawfly. Can. Ent. 88: 545. 1956.

Further information on conditions referred to in this Report or copies of the above articles can be obtained from the undersigned or the regional laboratory concerned.

B. M. McGUGAN, *Co-ordinator*,
Forest Insect and Disease Survey.

ATLANTIC PROVINCES

FOREST INSECT SURVEY

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INTRODUCTION

The spruce budworm continued to be the major forest insect problem in the Atlantic Provinces. In New Brunswick the numbers of dead and dying trees increased from 1955 and moderate to severe current defoliation was found over wider areas in the central and southeastern counties. In Nova Scotia the most important attacks occurred on Cape Breton Island, where larval populations decreased in Inverness County and increased in Victoria County from 1955. Infestations in Prince Edward Island have tended to subside except for a few areas along the northern coast. In Newfoundland high mortality of larvae and pupae caused striking reductions in populations.

Other important insects were the balsam woolly aphid, the winter moth, the white-marked tussock moth, the larch sawfly, the balsam-fir sawfly and the balsam gall midge.

The use of aircraft provided by Forest Protection Ltd., the New Brunswick Forest Service, Bowater's Newfoundland Pulp and Paper Mills Ltd., and the Anglo-Newfoundland Development Co., Ltd., is gratefully acknowledged. Personnel of Provincial and Dominion Forestry departments, Pulp and Paper companies, and the National Parks Service kindly submitted nearly 1000 insect collections and special reports. These were very helpful in appraising insect numbers and the nature and extent of infestations and damage.

The Fredericton and Debert Laboratories were responsible for forest insect surveys in the Maritime Provinces. The Laboratory at Corner Brook studied conditions in Newfoundland, which are dealt with in a separate section of this report.

Insect collections totalled 4,136. These were distributed by provinces as follows: New Brunswick, 1,511; Nova Scotia, 1,491; Prince Edward Island, 92; and Newfoundland, 1,042. Special reports on insect collections totalled 334. The following is a classification of collections by principal host trees:

Coniferous trees	Collections	Broad-leaved trees	Collections
Spruce	1,054	Birch	375
Balsam fir	915	Poplar	237
Tamarack	428	Maple	134
Pine	210	Oak	85
Cedar	31	Elm	36
Hemlock	12	Beech	22
		Miscellaneous hosts	597
		Grand Total	4,136

[1]Forest Biology Laboratory, Corner Brook, Newfoundland.
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MARITIME PROVINCES

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—The areas of moderate to severe infestation in New Brunswick increased to approximately 16,000 square miles from 13,000 square miles in 1955. The principal extensions were southward into the central counties of the Province. Much of this extension resulted from heavy moth flights from areas of severe attack in 1955. An infestation map, based largely on degrees of current defoliation, accompanies this report. In general, balsam fir stands in sprayed areas were severely infested, but conditions varied greatly in areas of different spraying histories and degrees of re-infestation. The infestations in sprayed areas are therefore not shown on the map, but will be reported elsewhere by F. E. Webb. Aerial and ground surveys in sprayed areas showed that small patches of dead and dying trees occurred in most areas of older attack. Fairly extensive areas of such trees were seen on the Upper Tobique watershed and near the headwaters of the Nepisiquit and Miramichi drainages.

Moderate to severe loss of current foliage occurred in the northern and central areas of York and Sunbury counties, northern Queens County, in Kent County, in parts of Westmorland County, and near Lakeview in the Fundy National Park. Although mature balsam fir stands are less extensive than in northern New Brunswick, many of the trees have been weakened by the balsam woolly aphid and they may not have sufficient vigor to withstand much defoliation. Except for some dead tops and a few dead trees in the Laketon, St. Margarets, Kouchibouquac, and Wine River areas near the Northumberland-Kent County Line, where severe defoliation has occurred for about 4 years, no serious deterioration of trees from budworm attacks has been observed in central and southeastern New Brunswick to date.

Heavy moth flights were observed again at Campbellton and at neighboring towns along the coast of Chaleur Bay. The heavy flights which occurred in the Fredericton area in 1955 were not observed in 1956. High egg-mass populations in most areas of northern, central, and southeastern New Brunswick suggest that numbers will be high enough to cause moderate to severe defoliation in 1957.

In Nova Scotia the infestation on white spruce on the eastern mainland near Cape George and Arisaig diminished; loss of new foliage was less than 10 per cent. On Cape Breton Island noticeable defoliation was confined to Inverness and Victoria counties. A slight southeasterly extension of areas of noticeable defoliation occurred in Victoria County. In general white spruce between Port Hastings and Cheticamp, through the Margaree Valley, and in the Rigwash and Presquile Valleys supported lighter budworm attacks than in 1955, but up to 80 per cent of the new needles was destroyed in some areas. On French Mountain the loss of current balsam fir foliage was generally light but ranged up to 50 per cent on dominant trees. Here and on MacKenzie Mountain most of the balsam fir trees are dead or dying from balsam woolly aphid attacks and persistent defoliation. The most severe budworm feeding was observed on white spruce in the North Aspy Valley, at Bay St. Lawrence, and in the Ingonish area where as much as 90 per cent of the new foliage was destroyed.

In several areas in northern Cape Breton Island, including Grand Etang, North Mountain, Bay St. Lawrence, and Ingonish, a deterioration of the older white spruce trees was evident from general graying and thinning of the crowns and failure to produce much new growth. Near Strathlorne, additional mortality of mature white spruce trees occurred and the older remaining trees were severely attacked in 1956.

Egg-mass populations decreased from 1955 in a number of areas on Cape Breton Island, but little change in degree of infestation is expected in 1957 in those areas that supported moderate to high budworm populations in 1956. No great changes in infestation boundaries seem likely. In Cumberland and Colchester counties egg masses were found at more locations than in 1955. Egg counts suggested that moderate to high population levels will occur in Cumberland County at Port Howe and at Conn's Mills in 1957.

In Prince Edward Island defoliation of scattered balsam fir stands continued, particularly along the northern shore between Cavendish Beach and Corran Bay, where the loss of new needles ranged from 30 to 100 per cent. Local infestations of moderate intensity were observed near Portage in Prince County and in the Mount Stewart area of Queens County. Elsewhere defoliation was light. Egg sampling from 46 locations indicated little change can be expected in 1957.

	Reports	Collections	Larvae per tree sample	
			Av.	Dev. from 1955
New Brunswick	18	498	11.6	—0.5
Nova Scotia	20	160	15.7	—8.2
Prince Edward Island	2	53	2.6	—

Winter Moth, *Operophtera brumata* (L.).—The winter moth is a European insect known to be present on this Continent only in Nova Scotia. The distribution was much the same as in 1955 except for collections from Stellarton, New Minas, Kentville, and Berwick. Infestations from the head of St. Margaret's Bay to Mahone Bay, near Milton, and at Grand Pré remained severe. Defoliation was generally severe wherever apple, red oak, elm, and red maple trees occurred between Newport Corner and St. Croix in Hants County, between Port Mouton and Port Joli and between Pleasant River and Caledonia in Queens County, at Cookville and between Hubbards and Sims Settlement in Lunenburg County, and at Tufts Cove and near Jollimore in Halifax County. Defoliation was moderate in areas of older attack between Bridgewater and Liverpool and near New Germany.

The winter moth and the fall cankerworm have often been associated in the same areas. Between Bedford and Waverley, Halifax County, the fall cankerworm predominated for a number of years, causing moderate to severe defoliation on red oak, maple, and wire birch. In 1956, however, winter moth populations were about five times those of the fall cankerworm.

In co-operation with the Insect Systematics and Biological Control Unit of the Entomology Division, two shipments of European parasites were released near Bridgewater. The species were *Cyzenis albicans* (Fall.) and *Agrypon flaveolatum* (Grav.). The possibility of using a virus disease to control this insect is being studied.

	Reports	Collections
Nova Scotia	14	198

Fall Cankerworm, *Alsophila pometaria* (Harr.).—This insect caused light defoliation on elm, red maple, and red oak trees at Sheffield and in the Portobello River area in New Brunswick. Some elm trees were severely defoliated in Fredericton.

Near Wellington Station, Halifax County, N.S., several hosts, including red oak, red maple, alder, willow and hawthorn, were severely defoliated for the third consecutive year. At Sims Settlement, Lunenburg County, red oak stands were almost completely stripped of foliage. In areas where the fall cankerworm

and winter moth were associated, the proportions of the former to the latter were as follows: Timberlea, 1:1.5; Head of St. Margaret's Bay, 1:9; Sims Settlement, 4:1; Pinehurst, 1:3; Port Mouton, 1:3; Clyde River, 2:1, and at Shelburne, 1:1.

	Reports	Collection
New Brunswick	1	5
Nova Scotia	4	52
Prince Edward Island	1	6

Balsam Woolly Aphid, *Adelges piceae* (Ratz.).—This insect remained within its known boundaries of occurrence in the Maritime Provinces. Plot studies in New Brunswick indicated that "stem attacks" were slightly more severe than in 1955. The "gout" form of injury is more common than "stem attack" and has caused a serious general deterioration of balsam fir trees in the central and southern parts of the Province for 20 years or more.

In Nova Scotia severe "stem attacks" were observed at Harrison Settlement, Cumberland County; at Middle Stewiacke, Colchester County; at Beaver Lake, Pictou County; and on the Musquodoboit-Sheet Harbour Road, Halifax County. Deterioration of balsam fir from "gout" was general near the coast up to elevations of several hundred feet. Dead and dying trees were numerous in many areas of Victoria and Inverness counties of Cape Breton Island. This deterioration has been accelerated in some areas by attacks of defoliating insects, including the black-headed budworm and the spruce budworm.

During the past few years, indications of recovery of growth in leaders and topmost branches after "gout" injury has been common in many areas. Such "recovery", however, may only be temporary.

The program of introducing and studying the effectiveness of European predators was continued in co-operation with the Insect Systematics and Biological Control Unit. The predators introduced in New Brunswick in 1956 were *Aphidecta obliterata* L., *Cremifania nigrocellulata* Cz. and *Exochomus 4-pustulatus* (L.).

	Reports	Collections
New Brunswick	8	2
Nova Scotia	11	0
Prince Edward Island	1	0

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.).—Population levels of this insect remained low throughout the Maritime Provinces during 1956.

	Reports	Collections	Larvae per tree sample	
			Av.	Dev. from 1955
New Brunswick	3	59	0.8	+0.1
Nova Scotia	7	54	0.8	—0.1

Pine Leaf Chermes, *Pineus pinifoliae* (Fitch).—Dead white pine shoots, resulting from moderate to severe infestations in 1955, were numerous at Upper Gagetown, Queens County; at the Acadia Forest Experiment Station, Sunbury County; at Scotch Lake, Bear Island, Hanwell Road, Waasis Road, and Magaguadavic Lake, York County; and at Northampton, Carleton County. The insect was comparatively scarce in 1956, following the usual biennial cycle of abundance.

	Reports	Collections
New Brunswick	7	29

Beech Scale, *Cryptococcus fagi* (Baer.).—The tally of trees on plots and general observations indicated little or no change from 1955 in the distribution and intensity of scale attacks in the Maritime Provinces. Infestations remained light to moderate.

	Reports
New Brunswick	3
Nova Scotia	9

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—Despite extensive sampling throughout the Maritime Provinces, this insect was found only in Halifax County, N.S. The defoliation on tamarack trees at Black Point, where a localized infestation occurred in 1955, continued to be light. Several colonies of larvae were found on a few trees between Goff's Corner and Devon on the Old Guysborough Road, but defoliation was negligible.

	Reports	Collections	Larvae per tree sample	
			Av.	Dev. from 1955
New Brunswick	3	0	—	—
Nova Scotia	4	46	3.3	+1.7

Larch Casebearer, *Coleophora laricella* (Hbn.).—Browning of tamarack foliage was observed only in Nova Scotia. Light defoliation occurred from Sable River to Birchtown, Shelburne County, and near Mount Uniacke and Lily Lake, Hants County. A few small trees were severely defoliated at Upper Sackville, Halifax County.

Casebearers were counted at sampling stations in New Brunswick and Nova Scotia, by techniques described in the 1955 Report. The average number of insects per sample in each district was as follows:

District	No. sampling stations	Av. No. cases per sample	Population changes in 1956
Southern New Brunswick	12	0.7	Threefold increase
Northeastern New Brunswick	9	0.3	Slight increase
Northwestern New Brunswick	4	0.3	Slight decrease
Eastern Nova Scotia	16	0.2	Slight decrease
Western Nova Scotia	16	0.9	Slight decrease

	Reports	Collections
New Brunswick	4	48
Nova Scotia	3	37
Prince Edward Island	1	0

European Spruce Sawfly, *Diprion hercyniae* (Htg.).—This sawfly continued to be common on spruce trees throughout the Maritime Provinces, but population levels remained low. Studies by D. E. Elgee showed that the virus disease was present in 0.3 and 4.5 per cent of the larvae collected from two plots near Fredericton; the emergence of introduced parasites is incomplete at time of writing, but parasitism will probably range from 20 to 30 per cent. Both control agents were found in collections from other widely separated points.

	Reports	Collections	Larvae per tree sample	
			Av.	Dev. from 1955
New Brunswick	9	76	1.5	+0.6
Nova Scotia	7	110	1.3	+0.6

Yellow-headed Spruce sawfly, *Pikonema alaskensis* (Roh.).—Infestations of this sawfly on white spruce reproduction at several locations in central York County, N.B., were much less severe than in 1955. At Scotch Lake, where

pasture-type trees have been attacked since 1953, light to moderate defoliation was observed over about 3 acres. Light defoliation occurred on a few scattered trees at Zeeland.

	Reports	Collections
New Brunswick	2	29
Nova Scotia	3	10

Black-headed Budworm, *Acleris variana* (Fern.).—Populations of this insect remained at low levels throughout the Maritime Provinces, but numbers increased slightly in some areas of northwestern New Brunswick.

	Reports	Collections	Larvae per tree sample	
			Av.	Dev. from 1955
New Brunswick	5	57	0.7	+0.2
Nova Scotia	5	11	0.4	—0.8

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.).—In Nova Scotia the severe infestations of this insect reported in 1955 at Truro, near Mahone Bay, and in Halifax persisted with little change in intensity. A Scots pine hedge at Lunenburg and several mugho pine plantings at Middleton were moderately infested. A red pine plantation near Lorne supported small numbers of shoot moths.

	Reports	Collections
Nova Scotia	3	2
Prince Edward Island	1	0

Satin Moth, *Stilpnotia salicis* (L.).—Population levels were very low between Woodstock and Bristol, New Brunswick, where Carolina and silver poplar trees were moderately to severely attacked from 1950 to 1955. In Campbellton defoliation of Carolina poplar ranged from 10 to 90 per cent, and silver poplar trees lost about half their leaves. Light to moderate defoliation was observed on Carolina poplar at Douglastown and East Bathurst and on silver poplar at Covedell and Coldstream.

On Cape Breton Island, N.S., at Belle Cote and Strathlorne a few silver poplar trees were lightly defoliated.

In Prince Edward Island defoliation of Carolina poplars was light at New Glasgow and moderate to severe at Rusticoville and at Midgell.

	Reports	Collections
New Brunswick	6	9
Nova Scotia	1	2
Prince Edward Island	1	3

White-marked Tussock Moth, *Hemerocampa leucostigma* (J. E. Smith).—This insect caused light to moderate defoliation of maple, poplar, tamarack, and balsam fir trees at Sackville, Dorchester, Memramcook, and Aboujagane in Westmorland County, New Brunswick.

Except for decreased numbers in the Craignish Mountain and Grand Anse areas, the infestations in Nova Scotia, some of which have persisted since 1953, showed a marked increase in severity and extent. The principal infestations, as shown on the accompanying map, occurred in Yarmouth, Cumberland, Colchester, Hants, Halifax, Pictou, Guysborough, Victoria, and Cape Breton counties. Hosts most frequently attacked were white birch, yellow birch, apple, red maple, balsam fir and tamarack trees, berry bushes, and in some cases, garden crops. Although parasitism was common, a polyhedral virus seemed to be a more effective control agent. Virus extract has been prepared and will be disseminated in some areas in 1957 to aid in controlling this pest.

Light defoliation was observed on deciduous and coniferous trees near St. Nicholas and at Orwell, Prince Edward Island.

	Reports	Collections
New Brunswick	7	35
Nova Scotia	19	152
Prince Edward Island	1	0

Birch Skeletonizer, *Bucculatrix canadensisella* Chamb.—No infestations of this insect were observed in New Brunswick or on Prince Edward Island. In Nova Scotia, where moderate to severe browning of birch trees was common from 1952 to 1955, defoliation was light.

	Reports	Collections
New Brunswick	1	3
Nova Scotia	2	0

Fall Webworm, *Hyphantria cunea* (Drury).—Population levels of this insect increased in all three provinces. It was found on a variety of hosts, including alder, chokecherry, apple, pin cherry, hawthorn, American elm, and Manitoba maple. In New Brunswick the most severe defoliation was observed in York County and from St. Louis to Moncton. Infestations in Nova Scotia seemed to be widely distributed throughout the whole Province. In Prince Edward Island light infestations were observed at Glenfinnan, Pooles Corner, Newton, Rose Valley, and Burlington.

	Reports	Collections
New Brunswick	4	5
Nova Scotia	4	76
Prince Edward Island	1	0

Birch Leaf Miner, *Fenusa pusilla* (Lep.) and ***Birch Leaf Mining Sawfly,*** *Heterarthrus nemoratus* (Fall.).—The birch leaf miner caused severe browning of wire birch foliage between Woodstock and Northampton, from Blackville to Newcastle, in the Nashwaak Valley, and between Sussex and Moncton in New Brunswick. In Nova Scotia the association of both species was common. Birch foliage was severely browned in several areas of Cumberland, Colchester, and Pictou counties, between Kentville and Annapolis Royal, and near Bedford.

Light to moderate attacks of the birch leaf miner were observed in Prince Edward Island.

	Reports	Collections
New Brunswick	5	52
Nova Scotia	6	91
Prince Edward Island	1	9

Birch Casebearer, *Coleophora salmani* Heinr.—Up to 50 per cent of the foliage of white birch trees between Stanley and Covered Bridge, and at Wine River in New Brunswick were destroyed. In other areas of the Province the casebearer was present in small numbers.

On the mainland of Nova Scotia light defoliation of white birch trees and alder bushes occurred at Fenwick and Frazerville, Cumberland County. On Cape Breton Island near Wreck Cove and between Cape North and Bay St. Lawrence the foliage on small white birch trees and reproduction was about 70 per cent browned; damage was less on larger trees.

	Reports	Collections
New Brunswick	2	53
Nova Scotia	5	31
Prince Edward Island	1	1

Basswood Looper, *Erannis tiliaria* (Harr.).—Except for light defoliation on a few poplar, alder, and cherry trees near Campbellton, N.B., no infestations of this insect were observed in 1956.

	Reports	Collections
New Brunswick	2	4
Nova Scotia	—	5
Prince Edward Island	1	2

Balsam Gall Midge, Possibly *Itonida balsamicola* (Lint.).—A balsam midge, the larvae of which feed within the new needles and produce sub-globular swellings, was common on young balsam fir trees in many areas of the Maritime Provinces. Although little is known about the insect, severely infested needles drop from the tree thus affecting the quality of Christmas tree stock. About 90 per cent of the new needles were infested near Fredericton, at McIntyre Lake and Ben Eoin on Cape Breton Island, and at New Chester in Guysborough County.

	Reports	Collections
New Brunswick	2	22
Nova Scotia	8	5

Red-pine Sawfly, *Neodiprion nanulus nanulus* Schedl.—This sawfly caused moderate to severe loss of foliage in a 12-year-old plantation of some 70,000 red pine trees at the Acadia Forest Experiment Station, near Fredericton.

	Reports	Collections
New Brunswick	3	37
Nova Scotia	0	1
Prince Edward Island	1	0

Green-striped Mapleworm, *Anisota rubicunda* (Fabr.).—A localized infestation of this insect occurred on maple trees near Carroll's Crossing, Northumberland County, N.B. Defoliation was mostly light to moderate but a few trees lost about 90 per cent of their leaves.

	Reports	Collections
New Brunswick	2	6
Nova Scotia	0	4

NEWFOUNDLAND

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—The outbreaks reported from St. Barbe and St. George's districts in 1955 subsided this year. A total of 4,261 larvae and pupae was received at the Corner Brook Laboratory from the following districts: Humber, St. George's, St. Barbe, Grand Falls, Bonavista South, and St. John's West.

Early collections of larvae from the southern part of St. Barbe District suggested that a moderate to severe budworm attack would occur in 1956. However, larval mortality during the summer reduced the budworm population from over 250 specimens per tree sample to less than 10. Prior to the reduction in numbers the insect destroyed up to 90 per cent of the new foliage of balsam fir near Rocky Harbour and Sally's Cove and from 20 to 40 per cent between St. Paul's Inlet and Parson's Pond. Corresponding defoliation on white spruce ranged from 30 to 40 per cent in the former locations and was less than 10 per cent in the latter area. No noticeable loss of old foliage occurred in 1956. Three additional small outbreaks, ranging in size from about 3 to 8 square miles, occurred in St. Barbe District as follows: 8 miles northeast of Daniel's Harbour, 6 miles northeast of Bellburns and in Hawkes Bay near Angle Pond. These

outbreaks were noted from the air after budworm feeding was complete but ground observations were only possible at Hawkes Bay. Defoliation of balsam fir trees was confined almost entirely to the current year's growth and ranged from 50 to 80 per cent. One collection of 109 pupae was obtained from the outbreak and insectary rearing showed high mortality; 71.5 per cent of the pupae were parasitized and 24.8 per cent died from unknown causes.

In St. George's District a light infestation persisted on white spruce trees near Main River. Defoliation of new growth of both white spruce and balsam fir was less than 10 per cent.

Egg sampling indicated budworm population levels will be low in all districts in 1957.

Reports	Collections	Larvae per tree sample	
		Av.	Dev. from 1955
5	228	5.0	—6.4

Balsam Woolly Aphid, *Adelges piceae* (Ratz.).—This insect continued to be a serious problem in the balsam fir forests of western Newfoundland. The northern boundary of the main outbreak remained about 6 miles north of Black Duck. The eastern boundary extended about 25 miles inland from St. George's Bay (see accompanying map). New localized infestations were located in South Brook Valley, Humber District; at Trout River, St. Barbe District; and at Gillams and Summerside on the north side of Humber Arm. Local outbreaks, previously recorded at Frenchman's Cove and John's Beach, increased in area and severity of attack. Infestations at Three-Mile Dam and at Bowater Park in South Brook have been clear cut. A clear-cutting operation in the outbreak at Wild Cove Point has not been completed. No change occurred in the boundary of the outbreak on the Avalon Peninsula. On the Burin Peninsula the infested area included 40 to 50 square miles, and extended between Garnish to a point about a mile south of Marystown and from Frenchman's Cove to Epworth. The most severe injury occurred near Marystown and Winterland. This infestation does not appear to be more than five to eight years old.

"Gout" was the only form of injury observed on the Burin and Avalon Peninsulas. In western Newfoundland "gout" occurred over most of the infested area but "stem attack" has become more evident in recent years and was responsible for mortality of balsam fir in the Bottom Brook and Little Barachois Brook regions. "Stem attacks" were observed recently in several mature stands in the Fishells River area.

Comparisons of data obtained annually from balsam woolly aphid plots established in western Newfoundland in 1951 showed a steady increase in the severity of the aphid outbreak over the past five years. The percentage of infested trees has increased from 30 to 97. The percentage of severely infested trees has increased from 10 to nearly 40. However, the percentage of trees actually dead from "gout" is still less than 5.

Three shipments of a European predator, *Neoleucopis obscura* (Hal.), totalling 342 living specimens, were released near Corner Brook. Twenty-nine specimens of the predator *Pullus impexus* (Muls.), were recovered near Wild Cove Point where this species was released in 1954. Two larvae of the same species were recovered at Barachois Brook, where a release was made in 1955. No specimens of *Laricobius erichsonii* (Rosen.) were recovered. All the trees that were stem attacked in 1954 and 1955, in areas where *L. erichsonii* was liberated, have been killed.

Reports	Collections
3	5

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.).—The severe outbreaks that were discovered in the Hare Bay region of the Northern Peninsula in 1952 have ended. Populations were low in all districts.

Reports	Collections	Larvae per tree sample	
		Av.	Dev. from 1955
2	58	0.8	—2.6

Balsam Fir Sawfly, *Neodiprion abietis* (Harr.).—An outbreak continued in the Gallants and George's Lake area of St. George's District for the third consecutive year. The infestation was spotty over an area of about 25 square miles. Reproduction 8 to 15 feet high in cut-over areas was injured most severely, although mature trees bordering cutovers were also defoliated. Defoliation of old needles of balsam fir ranged from 25 to 85 per cent; a trace to 10 per cent of the new foliage was destroyed. In many areas severe defoliation in 1955 was followed by light infestations in 1956.

Reports	Collections
4	63

Spruce Budmoth, *Zeiraphera ratzeburgiana* Sax.—Population levels in St. George's District decreased in 1956. In several sections of the Avalon Peninsula, particularly near Clarke's Beach, loss of new foliage on white spruce ranged from 50 to 60 per cent. No larval collections were received from the area and the defoliation was not observed until late September. However, characteristic feeding on new shoots and the webbing of terminal needles suggested that this was the species responsible.

Reports	Collections
3	32

European Spruce Sawfly, *Diprion hercyniae* (Htg.).—Little change occurred in the status of this insect. Collections were received from all sections of the Island except the South Coast and the Avalon Peninsula. The largest collections originated in Humber District, where the population level was less than four larvae per tree sample.

Reports	Collections	Larvae per tree sample	
		Av.	Dev. from 1955
2	50	1.6	—0.2

Black-headed Budworm, *Acleris variana* (Fern.).—The number of larval collections of this species was again low this year. The majority of the specimens collected came from Humber District.

Reports	Collections	Larvae per tree sample	
		Av.	Dev. from 1955
1	23	0.4	—0.4

Eastern Spruce Bark Beetle, *Dendroctonus piceaperda* Hopk.—Damage was common throughout northern and western Newfoundland where small patches of dead white spruce trees were seen from the air. South of Serpentine Lake this beetle has killed several hundred over-mature white spruce trees, and other trees are dying annually from attacks in a white spruce stand near Main River Bridge, St. George's District.

Reports
5

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—Larch sawfly population levels declined in most sections of central and eastern Newfoundland in 1956. Defoliation was light in most cases and not over 40 per cent. However, isolated areas of high sawfly populations, where defoliation ranged from 50 to 80 per cent, occurred at Buchans Road, 21 miles from Badger, between Swift Current and Goobies, and between Goobies and Arnold's Cove. Severe defoliation by the larch sawfly was observed from the air in a number of areas on the Northern Peninsula. In western Newfoundland a small outbreak was recorded near Corner Brook. The severe outbreaks that have persisted throughout central Newfoundland for the past three years appear to be ending.

Reports	Collections	Larvae per tree sample	
		Av.	Dev. from 1955
14	116	5.7	—8.9

Larch Casebearer, *Coleophora laricella* (Hbn.).—Defoliation of tamarack by this species was generally negligible. However, light browning was observed in western Newfoundland at the Highlands and near St. Fintan's where slight population increases occurred. Elsewhere in the Province there was no noticeable change in casebearer numbers. This is the fifth consecutive year that larch casebearer population levels have been low.

Reports	Collections
24	28

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.).—Several reports were received of shoot moth damage to ornamental red pine trees in the Corner Brook region. This species was first collected in western Newfoundland in 1955.

Large Spruce Weevil, *Hylobius* sp.—Injury to Scots pine and red pine plantations was observed at Collier's Ridge and F. Frost reported weevil damage in pine plantations near the Salmonier line. Injury to pine by these weevils has been reported from central Newfoundland for a number of years.

Reports	Collections
2	2

Satin Moth, *Stilpnotia salicis* (L.).—Population levels remained high in central Newfoundland. Defoliation of ornamental poplars and willows was severe at Gander, Gambo, Bishop's Falls, and Deer Lake. Complete defoliation of trembling aspen trees in natural stands was recorded in the Rattling Brook region of Bishop's Falls and along the shores of Upper Gambo Lake.

Reports	Collections
10	70

Fall Webworm, *Hyphantria cunea* (Drury).—The infestations near Stephenville Crossing have subsided.

Reports
1

Bruce Spanworm, *Operophtera bruceata* (Hulst).—The outbreak of this species continued on white birch trees at Appleton, near Glenwood, where defoliation ranged from 10 to 90 per cent. Defoliation was observed also on pin cherry, speckled alder, and other hardwoods. The outbreak was confined to an area of slightly less than 1 square mile.

Reports	Collections
5	30

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.).—Population levels remained high in western Newfoundland. Defoliation of mountain ash trees was often complete.

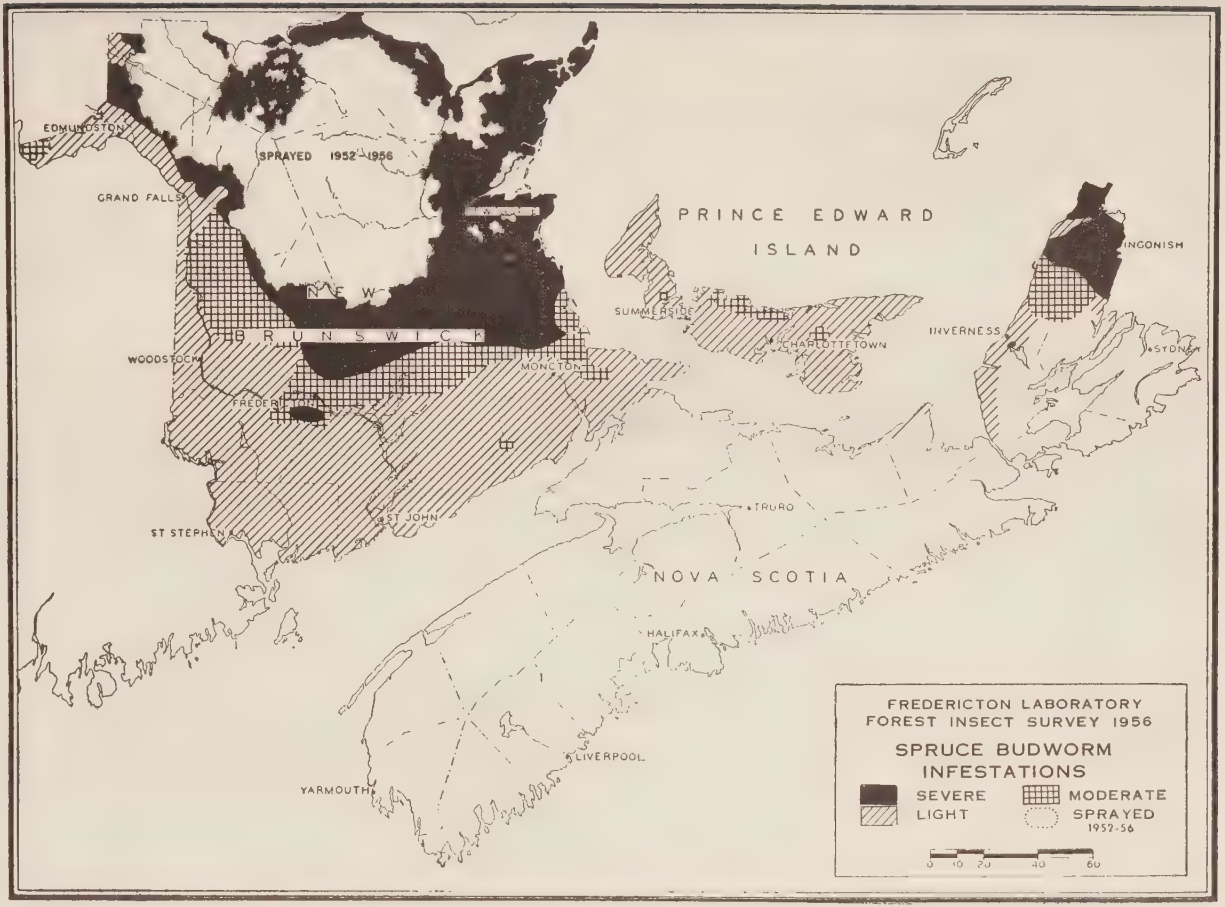
Reports	Collections
3	9

Birch Casebearer, *Coleophora salmani* Heinr.—A few specimens were collected near Stephenville Crossing and at Woody Point, Bonne Bay.

Reports	Collections
1	6

Dusky Birch Sawfly, *Croesus latitarsus* Nort.—This sawfly caused complete defoliation of white birch saplings, alder, and wild cherry about 5 miles east of Corner Brook. The outbreak covered less than an acre. This is the second consecutive year that an outbreak of this species has been reported in Newfoundland.

Reports	Collections
2	5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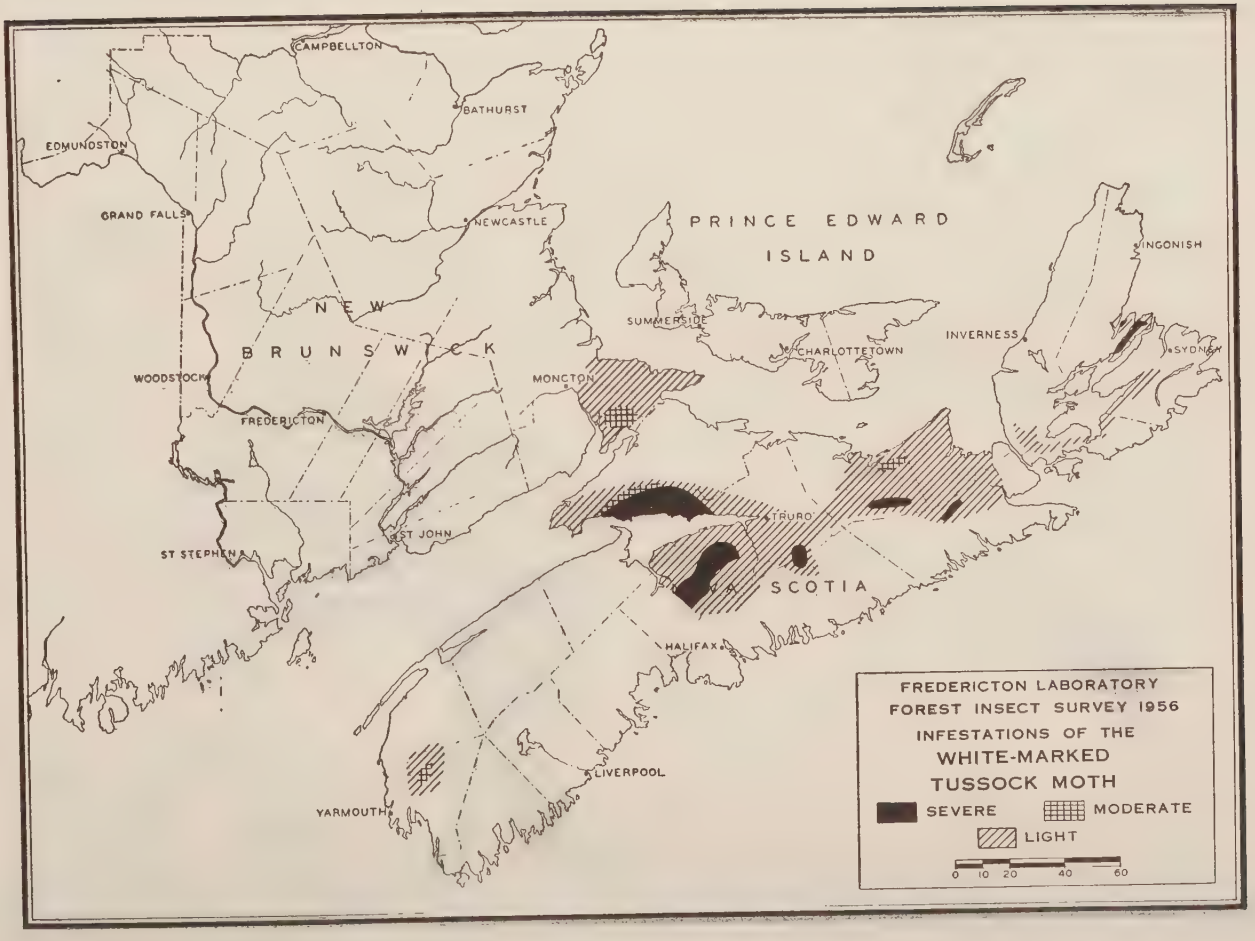
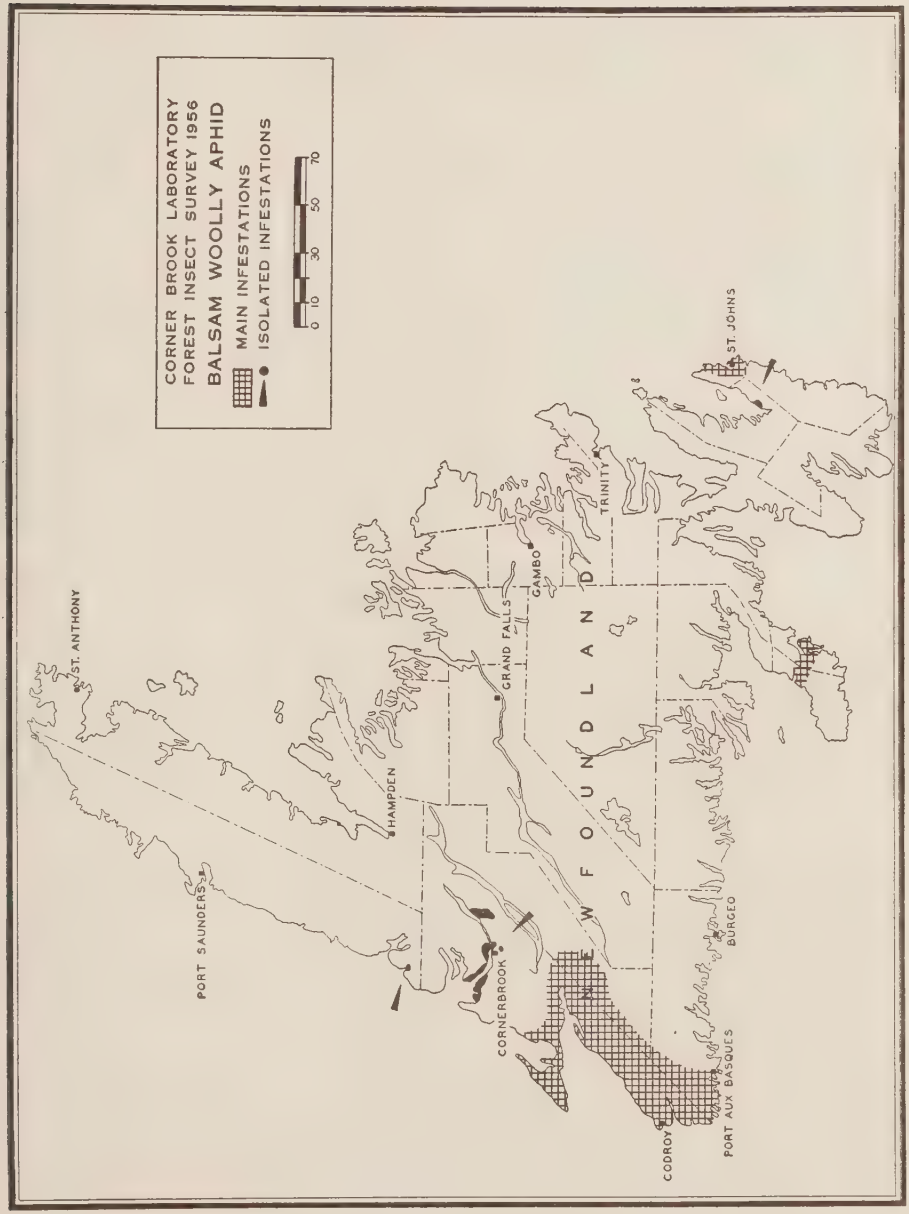
SPRAYED 1952-1956
GRAND FALLS
NEW BRUNSWICK
WOODSTOCK
FREDERICTON
MONCTON
ST JOHN
ST STEPHEN
PRINCE EDWARD ISLAND
SUMMERSIDE
CHARLOTTETOWN
INVERNESS
INGONISH
STONEY
TRURO
NOVA SCOTIA
HALIFAX
LIVERPOOL
YARMOUTH
FREDERICTON LABORATORY
FOREST INSECT SURVEY 1956
SPRUCE BUDWORM
INFESTATIONS
SEVERE
LIGHT
MODERATE
SPRAYED
1952-56
0 10 20 40 60


CAMPBELLTON
BATHURST
EDMUNDSTON
GRAND FALLS
NEWCASTLE
PRINCE EDWARD
ISLAND
INGONISH
N E W
B R U N S W I C K
SUMMERSIDE
CHARLOTTETOWN
INVERNESS
SYDNEY
WOODSTOCK
MONCTON
FREDERICTON
TRURO
ST JOHN
ST STEPHEN
N O V A S C O T I A
HALIFAX
LIVERPOOL
YARMOUTH
FREDERICTON LABORATORY
FOREST INSECT SURVEY 1956
INFESTATIONS OF THE
WHITE-MARKED
TUSSOCK MOTH
SEVERE
MODERATE
LIGHT
0 10 20 40 60


CORNER BROOK LABORATORY
FOREST INSECT SURVEY 1956
BALSAM WOOLLY APHID
MAIN INFESTATIONS
ISOLATED INFESTATIONS
0 10 30 50 70
ST. ANTHONY
PORT SAUNDERS
HAMPDEN
GRAND FALLS
GAMBO
TRINITY
ST. JOHNS
CORNERBROOK
BURGEO
CODROY
PORT AUX BASQUES
NEWFOUNDLAND

ATLANTIC PROVINCES

FOREST DISEASE SURVEY

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INTRODUCTION

During 1956, weather conditions greatly influenced the forest disease situation in the Atlantic Provinces. In January, freezing rains accompanied by high winds caused much damage to trees in eastern New Brunswick, northern Nova Scotia, and Prince Edward Island. Also during January, a long, mild spell occurred throughout the Atlantic Provinces. It produced the dullest, mildest, and wettest January ever experienced. This mild spell was responsible for considerable winter drying of conifers. May temperatures were below normal throughout the region and it was one of the coldest months of May on record. Although the cold caused no direct damage to trees, it delayed development and probably made the trees more susceptible to late frosts that occurred in all four provinces during June and caused damage in all but Newfoundland. The growing season was generally cool throughout the region with both precipitation deficiencies and excesses being recorded. During the summer, leaf-attacking diseases were common on most tree species. However, only a few of these diseases were severe enough to cause extensive leaf mortality.

A number of plots were established in the Maritime Provinces during 1956 as a means of determining the amount of damage caused by forest tree diseases. Emphasis was placed on poplar, beech, and birch.

A total of 472 collections were handled by the Survey during the year. As in previous years, members of the Botany and Plant Pathology Division, Mycology Unit, Ottawa, kindly assisted with the identification of the fungi involved. They have been responsible for naming many of the fungi listed in the final section of this report.

The distribution of the collections by tree hosts was as follows:

Coniferous trees	Collections	Broad-leaved trees	Collections
Balsam fir	64	Trembling aspen	58
White spruce	23	Red maple	33
Spruces (misc.)	17	Maples (misc.)	32
White pine	17	Poplars (misc.)	19
Jack pine	11	Yellow birch	17
Larch	9	Alder	16
Pines (misc.)	7	Pin cherry	16
Others	4	White birch	14
		Beech	14
Total	152	Ash	12
		Willow	12
		Red oak	12
		Elm	10
		Basswood	8
		Others	17
		Total	290

Miscellaneous hosts	30
Grand Total	472

Ice Storm Damage.—The accompanying map shows the extensive areas where severe ice storm damage occurred during January. A distinction is made between areas where the damage was widespread and areas where the damage was scattered. In the latter areas, damage was usually confined to the higher elevations. The damaging conditions occurred from January 5 to 7 in southern New Brunswick, Prince Edward Island, and Nova Scotia, and from January 10 to 12 in northern New Brunswick.

To assess the amount of damage caused by these storms, a number of sample plots were established and the trees classified according to the method used by Downs[1].

Trees were considered severely damaged if their tops were badly broken up, if their boles were broken off, or if they were uprooted or severely bent. Forked trees were included in this class if they were split at the crotch. Considerable variation in the severity of damage existed between and within localities and as a result no attempt has been made to give an estimate of the amount of damage.

All forest trees suffered severe damage but species of poplar and larch appeared to be the most susceptible. In some areas, they were the only species suffering severe damage and when damage occurred to other species in a stand, the damage suffered by poplar and larch was higher. In some plots 100 per cent of the poplar and larch were severely damaged. Plots were examined in which the percentages of trees severely damaged were:—balsam fir, 94 per cent; spruce, 93 per cent; maple, 67 per cent; and jack pine, 53 per cent. Of the ornamental trees, poplars and elms were most seriously affected.

Not only will the severely damaged trees be more susceptible to attack by wood-decaying fungi but many of them have died, or will die, as the result of injuries received. In one plot, approximately one-fifth of the severely damaged poplars have died. These trees had their boles broken off either below the crown or a short distance within it. It has been reported that the ice storms caused a reduction in seed supply. Most tree species had a heavy seed year in 1956 and in some areas many cones and flower buds were broken from the trees.

Late Frost Damage.—As mentioned previously, temperatures below freezing were recorded in all four Atlantic Provinces during June and resultant damage was observed in all the provinces except Newfoundland. These low temperatures occurred generally on June 8, 9, or 10, and again around June 20. Tree growth starts later in Newfoundland than on the mainland and it is probable that shoot development was not far enough advanced to be affected.

A list of the weather stations reporting minimum temperatures below 32°F. in June was obtained from the Air Services Branch, Department of Transport, Toronto, Ontario. This showed that freezing temperatures were recorded generally throughout eastern New Brunswick, eastern Nova Scotia, and Prince Edward Island. Frost damage was observed throughout these areas. Frosts were recorded also in Madawaska and Victoria counties of northern New Brunswick and frost damage was observed in these as well as in Restigouche County. Although the records and observations from northern New Brunswick were few, it is probable that frost damage occurred extensively through the area but was

[1]Downs, A. A. Glaze damage to the beech-birch-maple-hemlock type of Pennsylvania and New York. J. Forestry 36: 63-70. 1938.

spotty. The effects of frost were observed at a few isolated points in other parts of New Brunswick.

Balsam fir and white spruce were the two coniferous species most commonly affected. However, only the current year's growth was killed. The damage suffered by some of the broad-leaved species was more spectacular. In some parts of Northumberland County, N.B., Pictou and Victoria counties, N.S., up to 100 per cent of the foliage of beech trees was killed by the frost. In Pictou County, N.S., similar damage occurred to white ash foliage. Most other broad-leaved species suffered some damage but not as severely. Beech in Northumberland County, N.B., produced a new crop of leaves by the end of July. The new leaves were not so healthy in appearance as the original ones.

Unexplained Bare Twigs in the Tops of Hardwoods.—Bare twigs in the tops of birch, maple, and beech trees have been reported from various localities in the Maritime Provinces. On some of these twigs, the buds failed to open and on others, the leaves had died while still small. The cause of this condition is unknown but it is possible that the unfavorable weather conditions that occurred during 1956 were responsible. The bare twigs were not confined, however, to areas known to have suffered frost damage.

Ink Spot of Aspen.—Ink spot of aspen caused by *Ciborinia whetzelii* (Seav.) Seav. occurred in varying intensities throughout New Brunswick. The greatest damage occurred in northern New Brunswick (Victoria, Madawaska, Restigouche, and Gloucester counties) where as high as 75 per cent of the leaves were killed on some of the trees. A "brown leaf" condition was spotted during spruce budworm aerial surveys in the lower part of the Green River Watershed (Madawaska Co.). Ground observations confirmed the cause to be *Ciborinia whetzelii*. A small area in Westmorland County, N.B., was observed in which up to 50 per cent of the foliage on some trees was browned by this disease.

Hypoxylon Canker on Poplar.—Twenty-three plots (mostly one-fifth acre) were established in New Brunswick, Nova Scotia, and Prince Edward Island during 1956. Out of the 1,222 poplar trees (living or dead) occurring on these plots, 140 or 11.5 per cent had cankers caused by *Hypoxylon pruinatum* (Klot.) Cke. Of these trees, about 3 per cent had been killed by the cankers. The plots showed considerable variation in the amount of infection, the percentage ranging from 0 to 38.

Red Flag of Balsam Fir.—Dead branch tips on balsam fir were again common in the Maritime Provinces. In the 1954 Report, it was stated that this condition was probably caused by *Valsa friesii* Duby. This conclusion was based on a previous report[1] that a similar disease had been produced on balsam fir in Nova Scotia by the girdling-fungus *Valsa friesii*. This fungus has not been observed on the cankered branch tips while another fungus, *Fusicoccum abietinum* Prill. & Delacr. occurs consistently. *Fusicoccum abietinum* has been reported as causing a similar condition on small fir branches in Europe.

Ash Rust.—Attack by the ash rust (*Puccinia sparganioides* Ell. & Barth.) was generally lighter in western Nova Scotia during 1956 than in previous years. It was reported as being heavy around Crystal Cliffs, Antigonish County, in eastern Nova Scotia.

[1]Faull, J. H. Notes on forest diseases in Nova Scotia. J. Arnold Arboretum 11: 55-58. 1930.

Cherry Blight.—Pin cherry suffered very little damage from the blight that was common and widespread in the Maritime Provinces during 1954 and 1955.

Oak Leaf Blister.—*Taphrina caerulescens* (Mont. & Desm.) Tul. caused fewer infections and smaller leaf blisters to red oak in central and southern New Brunswick than in 1955.

Willow Blight.—Willow blight damage caused by *Fusicladium saliciperdum* (Allesch. & Tub.) Lind. and *Physalospora miyabeana* Fuk. was heavier in the Saint John River Valley of New Brunswick in 1956 than in 1955.

Tip Blight of Aspen.— *Pollaccia radiosa* (Lib.) Bald. & Cif., as usual, was common and widespread throughout the Atlantic Provinces.

Dutch Elm Disease.—In 1955, the Dutch elm disease caused by *Ceratostomella ulmi* (Schwarz) Buisman was reported at Orono, Maine, approximately 75 miles from the New Brunswick border. Scouting in New Brunswick during 1956 by members of the Plant Protection and Forest Biology divisions failed to locate any infected trees.

Elm trees in southeastern New Brunswick and northern Nova Scotia were badly damaged by the ice storm of January. The dead wood produced by this storm should provide excellent conditions for the vector, *Hylurgopinus rufipes* (Eichh.).

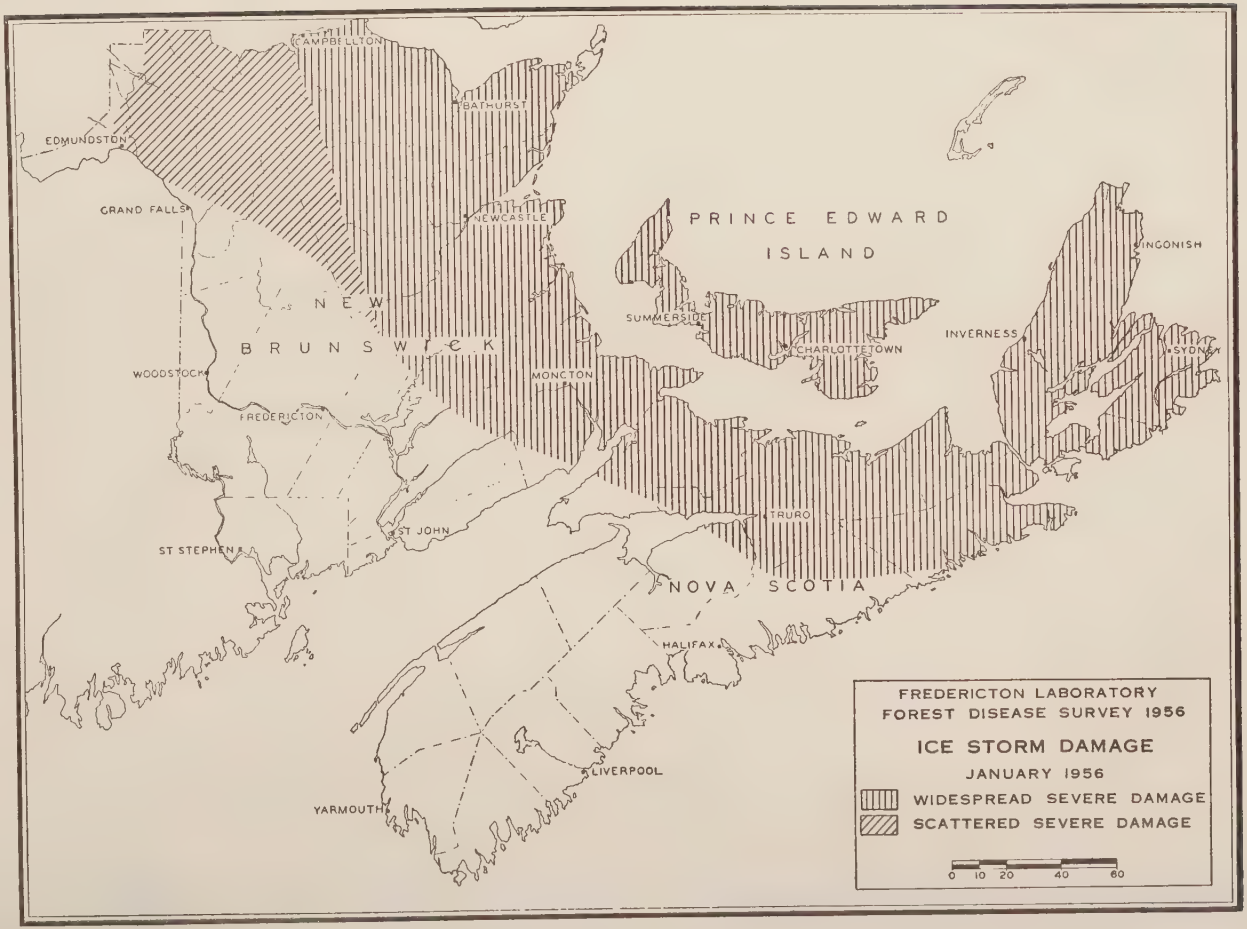
OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Alder	*Erysiphe aggregata* (Pk.) Farl.	Hammond River Bridge, Ripples, Lake George, Hardwood Ridge, Robertsons Point, Youngs Cove, Springhill, N.B.	Powdery mildew on catkins. First herbarium records but probably widely distributed.
	Septoria alni Sacc.	Woodside, Kent Jct., Kouchibouguac, Hardwood Ridge, N.B.	Causes a leaf spot. First record for district.[1]
Ash, mountain	*Micropera sorbi* (Fr.) Sacc.	Robertsons Point, N.B.	Occurred on dead branches of a living tree. First herbarium record. First record for New Brunswick.
	Sphaeropsis malorum Pk.	Robertsons Point, N.B.	Occurred on dead branches of a living tree. First herbarium record. First record for New Brunswick. First record on host for district.
Aspen, large-tooth	*Marssonina brunnea* (E. & E.) Sacc.	Youngs Cove, N.B.	Causes a leaf spot. First record for district.
Aspen, trembling	*Cladosporium subsessile* Ell. & Barth.	Goodyears Cove, Nfld.	Causes a leaf spot. First record for district.
	Marssonina brunnea (E. & E.) Sacc.	Cameron Mills, N.B.	Causes a leaf spot. First record for district.
	Septoria musiva Pk.	Coldstream, Covered Bridge, N.B.	Causes a leaf spot. First record for district.

[1]A record is considered a first for the district if the fungus is not listed in "The Fungi of New Brunswick, Nova Scotia, and Prince Edward Island" by L. E. Wehmeyer (N.R.C. No. 1890. 150 pp. 1950) or has not been mentioned previously in the Annual Reports of the Forest Insect and Disease Survey.

Host	Organism	Locality	Remarks
Basswood	*Gloeosporium tiliae* Oud.	Charlottetown, P.E.I., St. Andrews, N.B.	Causes a leaf spot. Some premature leaf fall was noted. New herbarium record.
Beech	*Gloeosporium fagicola* Pass.	Mazerall Sett., St. Anthony, Barnesville, Cromier Village, N.B., Trafalgar, N.S.	Causes a leaf spot. First records for district.
Birch, yellow	*Gloeosporium betulaeluteae* Sacc. & Dearn.	Bocabec Lake, N.B.	Causes a leaf spot. First record for district.
Birch, white	*Septoria betulae* (Lib.) West.	Bantalor, Hebron, Springhill, West Quaco, Hardwood Ridge, N.B., Crystal Cliffs, N.S., Hampden, Taylors Brook Rd., Nfld.	Causes a leaf spot. New herbarium records. New host record for district.
	Taphrina carnea Johans.	Hainsville, N.B., Charlottetown, P.E.I.	Causes a leaf blister. New host record for district.
Birch, wire	*Septoria betulae* (Lib.) West.	Zionville Rd., Currieburg Rd., N.B.	Causes a leaf spot. New herbarium records. New host record for district.
Butternut	*Melonconium oblongum* Berk.	Fredericton, N.B.	Causes a dieback. First record for district. This is the conidial stage of *Melanconis juglandis*. (E. & E.) Graves.
Cedar	*Pestalotia funerea* Desm.	Milkish, N.B.	Considered as occasionally causing a leaf blight. First herbarium record.
Cherry, pin	*Taphrina cerasi* (Fckl.) Sadebeck	Bantalor, N.B.	Causes a witches' broom and leaf curl. First herbarium record.
Maple, Manitoba	*Coryneum negundinis* B. & C.	Buctouche, N.B.	Causes a twig blight. First herbarium record.
Maple, red	*Cladosporium humile* J. J. Davis	Newcastle, N.B.	Causes a leaf spot. First record for district.
Maple, striped	*Taphrina letifera* (Pk.) Sacc.	Smoky Mt., N.S.	Causes a leaf spot. First record of a *Taphrina* on host.
Oak, red	*Coryneum kunzei* Corda	Fredericton, N.B.	Occurred on dead branches of living tree. First herbarium record. This is the conidial stage of *Pseudovalsa longipes* (Tul.) Sacc.
	Microsphaera alni (Wallr.) Wint.	Hebbs Cross, N.S.	Causes a powdery mildew. First herbarium record.
	Gloeosporium quercinum West.	Sypher Cove, Robertsons Pt., Boiestown, Douglas Harbor, N.B.	First record for district. Causes a leaf spot. This is the conidial stage of *Gnomonia quercina* Kleb.
Pine, jack	*Cronartium coleosporioides* (D. & H.) Arth.	Indian Falls, N.B.	Stem rust. First host record for district.
	Cronartium comandrae Pk.	Indian Falls, N.B.	Stem rust. First record for district.
Pine, lodgepole	*Cronartium cerebrum* Hedgc. & Long	Ripples, N.B.	Stem rust. 60% of trees in a plantation were heavily infected.
Pine, white	*Hypoderma desmazierii* Duby	Walkers Sett., Crocket Corners, Parkindale, N.B.	First herbarium record. Has been considered both as a weak or an aggressive parasite causing needle cast. The collections reported here were made from twigs that had been attacked by the pine leaf chermes, *Pineus pinifoliae* (Fitch).
Poplar, balsam	*Septoria populicola* Pk.	Lake George, N.B.	Causes a leaf spot. First record for district.
Poplar, Carolina	*Marrsonina brunnea* (E. & E.) Sacc.	Paradise, N.S.	See remarks under trembling aspen.
Poplar, Lombardy	*Taphrina populina* Fr.	Badger, Nfld., Paradise, N.S.	Causes yellow leaf blisters. First herbarium records.

Host	Organism	Locality	Remarks
Spruce, black.....	*Chrysomyxa pyrolae* (DC.) Rostr.	Hammond River Bridge, N.B.....	Cone rust. First record for New Brunswick. 5% of cones infected in area.
	Lophodermium piceae (Fckl.) Hohn.	Canaan Sta., N.B.. ...	Causes a needle cast. First herbarium record.
Willow.....	*Diplodina salicis* West.	Oak Pt., N B ..	Occurred on dead branches of living tree. First herbarium record.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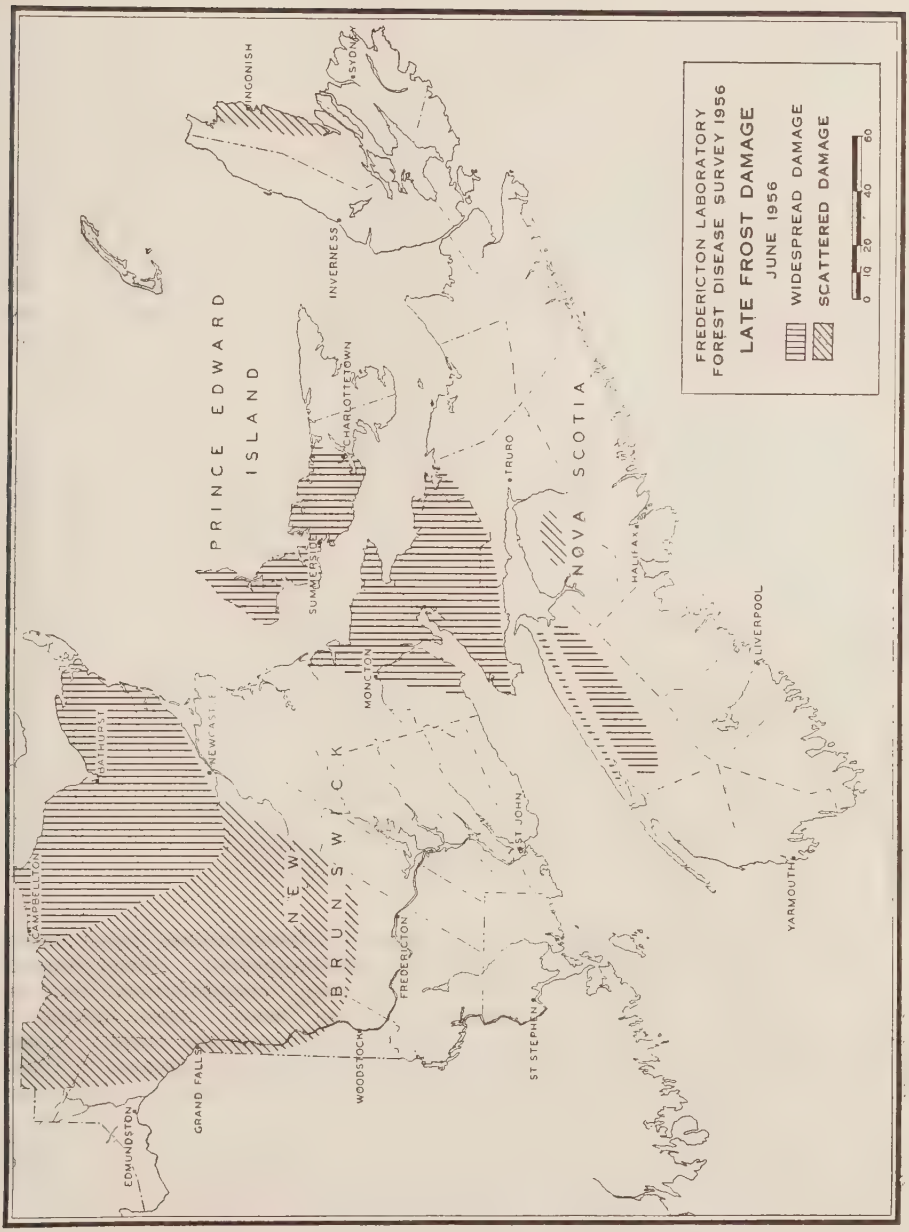
BATHURST
EDMUNDSTON
GRAND FALLS
NEWCASTLE
PRINCE EDWARD
ISLAND
INGONISH
NEW
BRUNSWICK
SUMMERSIDE
INVERNESS
SYDNEY
CHARLOTTETOWN
WOODSTOCK
MONCTON
FREDERICTON
TRURO
ST JOHN
ST STEPHEN
NOVA SCOTIA
HALIFAX
LIVERPOOL
YARMOUTH
FREDERICTON LABORATORY
FOREST DISEASE SURVEY 1956
ICE STORM DAMAGE
JANUARY 1956
WIDESPREAD SEVERE DAMAGE
SCATTERED SEVERE DAMAGE
0 10 20 40 60


FREDERICTON LABORATORY
FOREST DISEASE SURVEY 1956
LATE FROST DAMAGE
JUNE 1956
WIDESPREAD DAMAGE
SCATTERED DAMAGE
0 10 20 40 60
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
BATHURST
NEWCASTLE
CAMPBELLTON
GRAND FALLS
EDMUNDSTON
WOODSTOCK
FREDERICTON
MONCTON
ST JOHN
ST STEPHEN
SUMMERSIDE
CHARLOTTETOWN
INVERNESS
SYDNEY
PICTON
TRURO
HALIFAX
LIVERPOOL
YARMOUTH

PROVINCE OF QUEBEC

FOREST INSECT SURVEY

René Martineau and René Béique

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INTRODUCTION

Again in 1956 the Provincial Bureau of Entomology conducted the forest insect survey work in the Province in general, while the Forest Biology Laboratory carried out intensive surveys of the spruce budworm in eastern Quebec and of the jack-pine sawflies in the various regions where this tree species is prevalent. This report summarizes the observations made on these two insects as well as on the European spruce sawfly and the European pine shoot moth, two species of particular interest to the research program of this laboratory.

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—The severe outbreak continued in Quebec during the summer of 1956. The spruce budworm remained an acute problem in the lower St. Lawrence and Gaspe regions, the only areas where intensive budworm survey work was conducted during the summer. Aerial survey records, supplemented by ground observations at approximately 400 locations along accessible roads, form the basis for this report. The area sprayed in 1956 was approximately one half of that sprayed in 1955 and totalled 450,000 acres distributed between Rimouski-Mitis, Matapedia, Matane, and Chaleurs Bay districts where balsam fir mortality was imminent.

Spring emergence was delayed by approximately two weeks, due to adverse weather conditions which continued to be detrimental to the insect through the rest of its development. As a result, egg deposition took place unusually late. On the other hand, the extremely abundant production of flowers on balsam fir trees provided the young larvae with an ample food supply and enabled them to survive the critical period before the opening of the buds. This may explain why the insect population was generally higher in 1956 than in 1955. The infestations are illustrated on the accompanying map which concerns only the eastern Quebec regions.

Aside from the sprayed areas, only one stretch of forest land in Gaspe North County, north of the Shickshocks, now remains lightly infested. In the sprayed areas, there were variations in the degree of infestation, depending upon the year of spraying. With the exception of a small patch of "severe" in the Patapedia watershed, infestation conditions varied between light and moderate in areas sprayed in 1954, whereas they were generally light in the areas treated in 1955. The 1956 spraying operations saved some 50 per cent of the current year's foliage.

In the remaining balsam fir stands of eastern Quebec, the infestation varied from moderate to severe with highest concentrations in Bonaventure and Gaspe South counties. In some sectors severe back feeding occurred.

The center of infestation reported for the Lake St. John Region in 1955, remained active and increased in area. Information received from the North Shore Region indicated that the centers reported in 1954 and 1955 extended so

that large areas of the Laval, Bersimis and Papinachois watersheds were involved. Reports of an upsurgence of the spruce budworm around previous infestation centers in the Batiscan and Eagle watersheds were also received.

Sampling revealed that egg deposition was extremely high this year, although occurring relatively late in the season. At higher elevations many egg masses were still unhatched in mid-September. It is not expected that these eggs will survive the winter.

The egg-mass survey indicates that the strip in Gaspe North County mentioned above, will be lightly infested again in 1957. This is also true for the sprayed areas around Matane. On the contrary, areas sprayed in 1954 in the Rimouski-Mitis and Matapedia regions will probably be heavily infested in 1957. The areas treated in 1955 in the same regions and the Chaleurs Bay Region will have infestations varying from moderate to severe. In all areas reported as moderately and severely infested in 1956, high population levels are expected in 1957.

Jack-pine Sawfly, *Neodiprion swainei* (Midd.).—In 1956, special attention was given to the jack-pine sawfly in central Quebec. In addition to the territory covered in 1955, sampling was extended to the Lake St. John and Saguenay areas. Sample plots were established in 22 representative stands, in order to follow the progress of the outbreak. In each plot, 25 jack pine trees were tagged, described, and the defoliation estimated. Cocoon and egg counts were also made in each area. Similar records were taken in 175 additional temporary stations in co-operation with limit holders.

According to observations made in the field, the general decline in sawfly population levels noted last year was even more apparent in 1956. Centers of active infestation are now restricted to relatively small areas as indicated on the accompanying map. The most important points of infestation west of the St. Maurice River were located north of Manouane Lake and in Gosselin, Dupuis, and Livernois townships. In the Lake St. John area, small patches of infestation were located only in Deschene and Tremblay townships.

Adverse climatic conditions in the spring and early summer greatly retarded larval developments of the insect, so that large numbers of feeding larvae were killed by early fall frosts. This will undoubtedly result in a further reduction in population levels in 1957.

Among the parasites recovered from rearings, two species were *Perilampus hyalinus* Say and *Dahlbominus fuscipennis* (Zett.). The latter species, which is an imported cocoon parasite of the European spruce sawfly, had been obtained in 1954 and 1955.

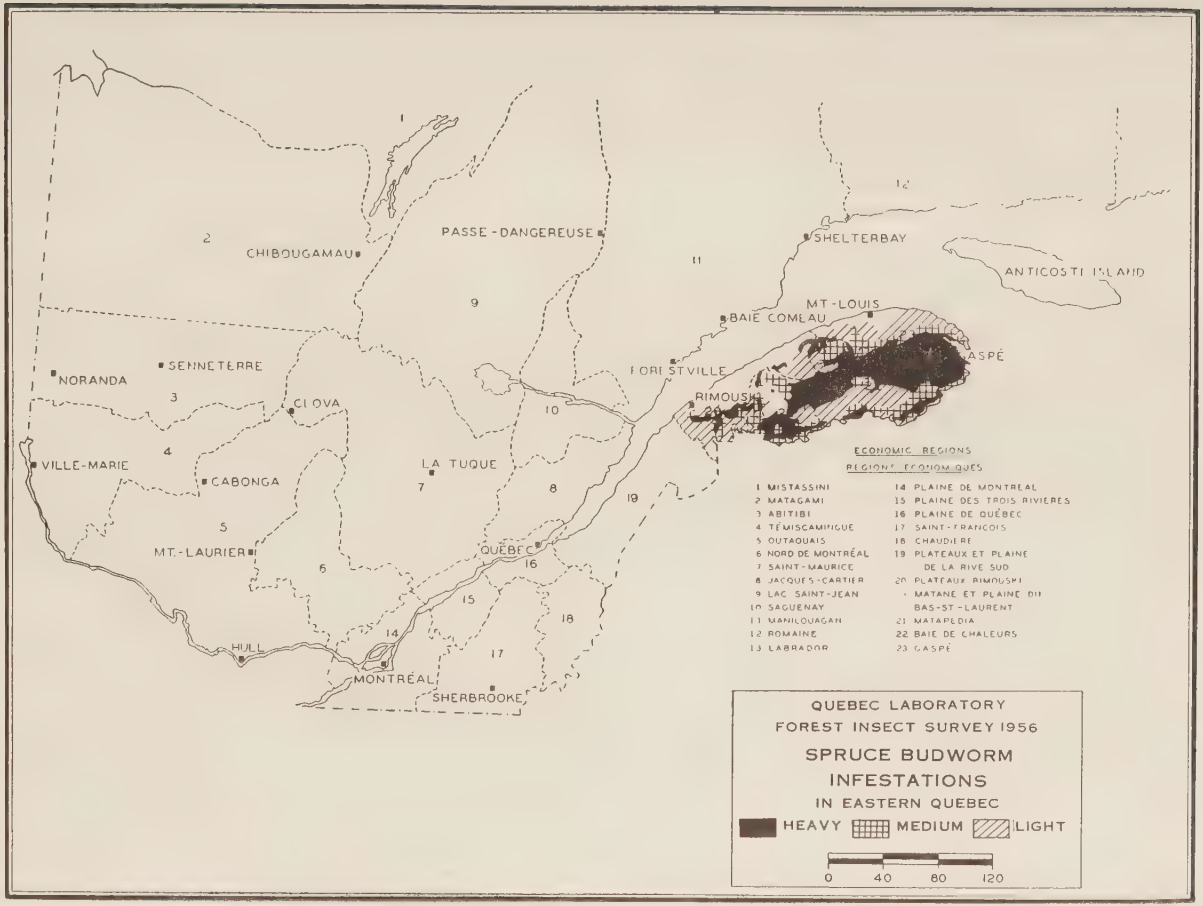
European Spruce Sawfly, *Diprion hercyniae* (Htg.).—According to sampling performed in 1956, the population level of this insect was more uniform than in previous years. Larvae were easily collected although in relatively small numbers from nearly all spruce stands sampled within a 100-mile radius of Quebec City.

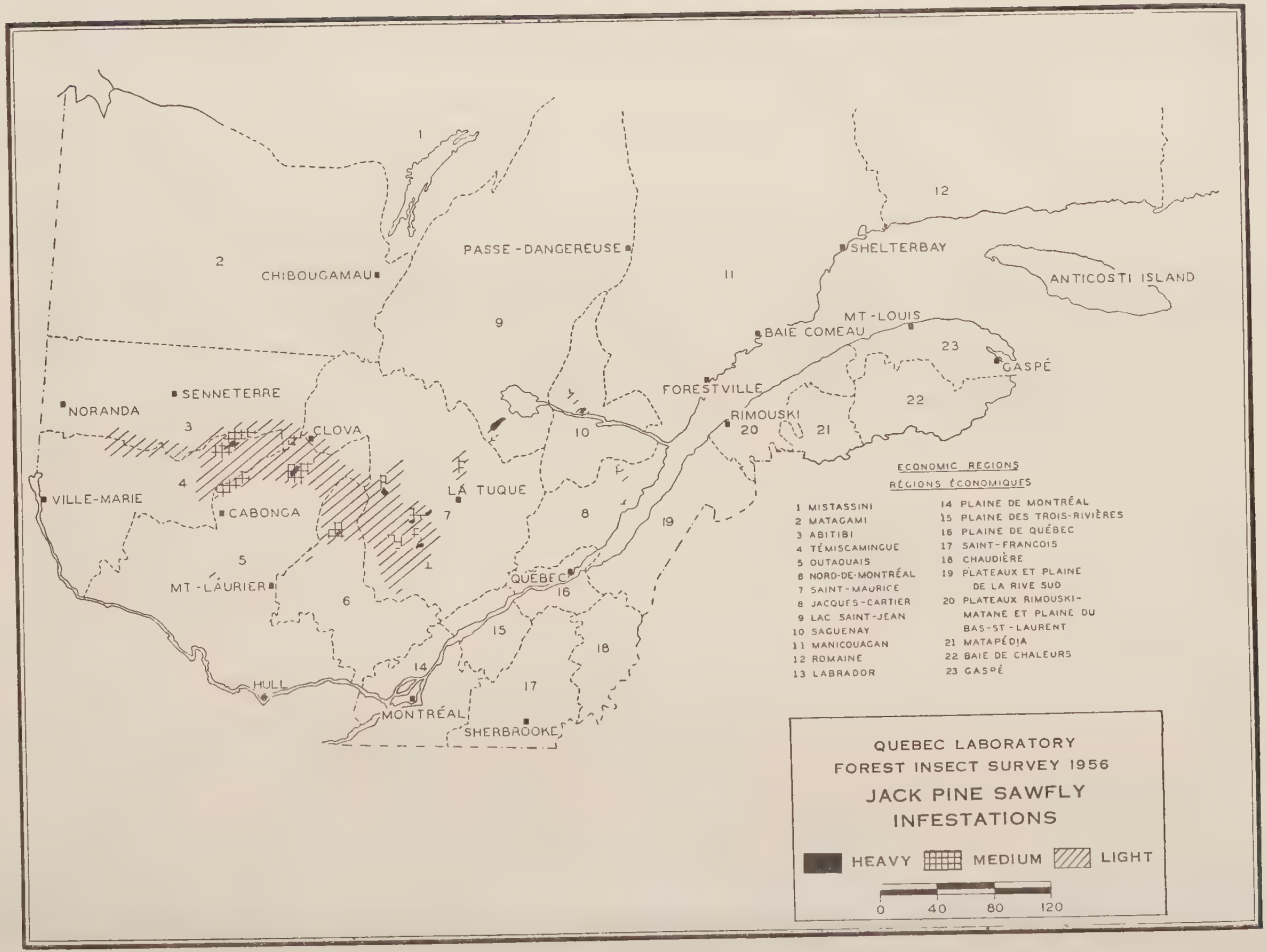
The infested plantation near Lake Megantic, mentioned in the 1955 Report, was sampled again in 1956. There was evidence of a slight decrease in the population level and of less variation in numbers from one tree to another. A plantation near Trois-Rivières was infested in 1956. Natural stands containing considerable numbers of spruce sawfly larvae were located at St. Nicholas, Ste. Agathe, and St. Sylvestre in Levis and Lotbinière counties.

Larval mortality from disease was observed in the field again in 1956. In laboratory rearings, disease mortality was lower than in 1955 but parasitism increased. The parasites recovered were all dipterous.

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.).—General scouting for this pest, which was reported in Quebec City for the first time in 1954, was conducted in the main cities of the Province. Infested Mugho pines were found only in Granby and Quebec.

Observations at Quebec City showed that more than 70 per cent of the overwintering larvae were killed and that during the summer about 25 per cent of the remainder were destroyed by parasites. Much reduced population levels are expected in 1957.


CHIBOUGAMAU
PASSE-DANGEREUSE
SHELTERBAY
ANTICOSTI ISLAND
MT-LOUIS
BAIE COMEAU
GASPÉ
FORESTVILLE
RIMOUSKI
SENNETERRE
NORANDA
CLOVA
VILLE-MARIE
CABONGA
LA TUQUE
MT.-LAURIER
QUÉBEC
HULL
MONTRÉAL
SHERBROOKE
ECONOMIC REGIONS
RÉGIONS ÉCONOMIQUES
1 MISTASSINI
2 MATAGAMI
3 ABITIBI
4 TÉMISCAMINGUE
5 OUTAOUAIS
6 NORD DE MONTRÉAL
7 SAINT-MAURICE
8 JACQUES-CARTIER
9 LAC SAINT-JEAN
10 SAGUENAY
11 MANICOUAGAN
12 ROMAINE
13 LABRADOR
14 PLAINE DE MONTRÉAL
15 PLAINE DES TROIS RIVIÈRES
16 PLAINE DE QUÉBEC
17 SAINT-FRANÇOIS
18 CHAUDIÈRE
19 PLATEAUX ET PLAINE DE LA RIVE SUD
20 PLATEAUX RIMOUSKI
21 MATANE ET PLAINE DU BAS-ST-LAURENT
22 BAIE DE CHALEURS
23 GASPÉ
QUEBEC LABORATORY
FOREST INSECT SURVEY 1956
SPRUCE BUDWORM
INFESTATIONS
IN EASTERN QUEBEC
HEAVY
MEDIUM
LIGHT
0 40 80 120


CHIBOUGAMAU
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SHELTERBAY
ANTICOSTI ISLAND
MT-LOUIS
BAIE COMEAU
GASPÉ
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RIMOUSKI
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14 PLAINE DE MONTRÉAL
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16 PLAINE DE QUÉBEC
17 SAINT-FRANCOIS
18 CHAUDIÈRE
19 PLATEAUX ET PLAINE DE LA RIVE SUD
20 PLATEAUX RIMOUSKI-MATANE ET PLAINE DU BAS-ST-LAURENT
21 MATAPÉDIA
22 BAIE DE CHALEURS
23 GASPÉ
QUEBEC LABORATORY
FOREST INSECT SURVEY 1956
JACK PINE SAWFLY
INFESTATIONS
HEAVY
MEDIUM
LIGHT
0 40 80 120

PROVINCE OF QUEBEC

FOREST DISEASE SURVEY

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INTRODUCTION

The unusually dry and warm weather of the 1955 season followed by a mild winter was responsible for the intense foliage injury of ornamental conifers during 1956 in Quebec. In some instances, twigs and small branches were killed, but in many cases the terminal buds of the affected trees did not suffer and green foliage appeared later in the spring. The cold spring of 1956 delayed the growing season by about three weeks, and in the Quebec City district maple buds did not open until the last week of May. In June and July, the amount of rainfall throughout the Province was above average resulting in an increase in foliage diseases, including those caused by rust fungi. In consequence of the cool wet summer, damage usually attributed to drought was at a minimum.

The number of disease samples received remains limited. The 252 collections of diseased material obtained in 1956 were distributed by tree species as follows:

Coniferous trees	Collections	Broad-leaved trees	Collections
Balsam fir	118	Trembling aspen	17
Jack pine	33	Willow	14
Black spruce	15	White birch	12
Blue spruce	10	Balsam poplar	5
White spruce	9	Others	10
Red spruce	2		—
Total	194	Total	58
Grand Total	252		

In addition to the above, cultures were made from 850 elm samples, 1,200 diseased conifer seedlings, and 2,058 conifer decay and disease specimens.

IMPORTANT DISEASES

Dutch Elm Disease.—During 1956, 850 elm samples were received at the laboratory for diagnosis and 647 yielded cultures of the Dutch elm disease fungus. Most of them were collected from known infected areas. An infected tree was found this year for the first time in Huntingdon County, the only county in southern Quebec where this disease has not previously been reported.

The six 1-square-mile permanent sample plots established in 1946 to study the rate of infection in the field, were tallied this year after ten annual inspections, so the many young trees which have grown during the past decade would be included. From a total of 2,630 elm trees in the sample plots, 62 new cases of infection were found and in the 1-mile-radius buffer zone 197 cases were found. This is an increase over 1955. In the 6 square miles under observation, 228 trees or 8.6 per cent were killed by the epidemic during the past 11 years.

Reports on the occurrence of the disease in most of the cities surveyed since 1945 are no longer available, except for Sherbrooke where 155 new infected trees were found. During the last 6 years, 905 diseased elms have been discovered within the limits of that town.

Hardwood Dying.—Except for trees already in an advanced stage of deterioration, most hardwood trees exhibited healthy green foliage during the last season. This condition was due to the cool wet weather of the summer months. In 28 of the 77 permanent sample plots established in 1953 and 1954 in various areas of the Province, the 988 white birch trees and 72 yellow birch trees examined did not show any appreciable changes in their deterioration ratings over preceding years. The same general results were obtained in two sample plots including 567 white birch trees, established in 1955 in Montmorency County for ecological studies.

Deterioration in White Spruce Plantations.—In the course of investigations on deterioration in white spruce plantations near Grand'Mère, trees in established plots were again rated for health. In plots containing less than 1,000 cubic feet per acre, the healthy trees have decreased from 9.3 per cent in 1953 to 3.8 per cent in 1954 and 1956, whereas, in better stocked plots, the percentage of healthy trees has increased slightly. The percentage of dead and dying trees, has increased from 71.8 in 1953 to 79.2 in 1954 and 84.4 in 1956 in plots of less than 1,000 cubic feet per acre. The same tendency is also evident in the better stocked plots, although to a lesser degree.

The situation is steadily becoming worse, with the most rapid decline in areas which have made the poorest progress in the past. The effects of the adverse weather during the 1955 season are reflected in the extremely poor growth in 1956. Plots treated with potassium and phosphorus however, suffered very little decrease in 1956 growth as compared with untreated plots. The response of white spruce to unfavorable environmental factors is greatly affected by the soil nutrient content.

Conifer Decays.—Field investigations on decay in balsam fir and red spruce stands in the southeastern part of the Province were completed in 1955. A total of 1,822 balsam fir and 644 red spruce trees on 26 one-quarter-acre sample plots was analyzed. Decay was found in 1,215 of the balsam fir and 217 of the red spruce trees.

The incidence of the more important decay fungi isolated is shown in the following table.

Organism	Balsam fir No. of infections	%	Red spruce No. of infections	%
Stereum sanguinolentum Alb. and Schw. ex Fries	417	34.82	29	13.36
Corticium galactinum (Fr.) Burt	401	32.92	61	28.11
Poria subacida (Pk.) Sacc.	116	9.55	8	3.69
Fomes pini (Thore) Lloyd	10	0.82	36	13.13
Coniophora puteana (Schum. ex Fr.) Karst.	64	5.19	16	7.37

In 1956, the same type of investigation was continued in the northern part of the Province along the Manicouagan River. A total of 2,190 trees were analyzed and decay organisms were isolated from 765 of the trees as follows:

Species	Number of trees	Number of infections	%
Balsam fir	1,111	421	37.9
Black spruce	640	129	20.2
Jack pine	439	215	48.8
Total	2,190	765	39.9

Diseases in Immature Balsam Fir Stands.—A study of diseases associated with immature balsam fir stands and their importance in the development of such stands was initiated in 1956 in the southwest section of Laurentide Park on the limits of St. Raymond Paper Company. During the field season, nine one-hundredth acre and one-fiftieth acre plots were established in immature balsam fir stands, ranging from 9 to 52 years, in which all trees were cut and the foliage, branches, trunks, and also 80 per cent of the root systems examined for diseases. A total of 1,293 isolations was prepared.

Of 2,617 living balsam fir trees examined, 25 per cent were affected by *Phacidium infestans* Karst., 28 per cent by *Lophodermium* sp., 19 per cent by *Adelopus balsamicola* (Pk.) Theiss., 11 per cent by *Trichosphaeria parasitica* Hartig, 7 per cent by *Hypodermella nervata* Darker, 5 per cent by an unidentified foliage disease, 1 per cent by *Peridermium balsameum* Peck, and less than 1 per cent by *Bifusella faullii* Darker. With the exception of *Phacidium infestans*, Karst., the rest of the foliage diseases are not economically important. A complete analysis of the data accumulated during this study is not yet available.

Young balsam fir trees with a dead leader and sometimes with killed lateral twigs have occasionally been noticed in Quebec during the past 25 years. Last summer this type of injury was quite common in a few young stands in the Laurentide Park. Affected trees are often distorted and produce multiple leaders. An unidentified species of *Godronia* was always found associated with necrotic areas of damaged or dead leaders.

Dying of Balsam Fir.—A preliminary study to determine the cause of this dying and the factors involved was undertaken in 1956. From various areas of the Province, 25 affected trees and, for comparison, the same number of healthy balsam fir trees of the same size were cut and analyzed.

On dead and dying trees insect galleries and fruiting bodies of fungi were common. *Nectria* sp. and *Dermea* sp. sporophores were most commonly found on dead tissues. In a few cases, *Valsa friesii* Duby and *V. kunzei* Fries were recorded. There is no evidence that any of these fungi are responsible for the condition.

Damping-Off.—In two provincial forest tree nurseries, located at Berthierville and at Proulx, investigations of seedling diseases was initiated last summer. From a total of 51,248 conifer seedlings examined at Berthierville, 29.8 per cent were killed by damping-off. The results by tree species were as follows: red pine 35.6; Scots pine, 22.1; jack pine, 18.1; white spruce 26.6; and black spruce 56.5 per cent. At the Proulx nursery 9,507 white spruce seedlings were examined and the average loss was 29.3 per cent. In the fall-sown beds the average killing by damping-off reached 52.4 per cent and in the spring-sown beds, the loss was 25.8 per cent. Some 1,200 fungi cultures were isolated from diseased seedlings. Among the fungi isolated *Rhizoctonia solani* Kühn and *Fusarium* species were the most common.

Needle Yellowing of Jack Pine.—A striking needle yellowing was prevalent on jack pine in the upper St. Maurice area during the summer of 1956. This foliage discoloration, which occurred only on 1- or 2-year-old needles, was evenly distributed throughout a number of young stands. Fruiting bodies of *Lophodermium pinastri* (Schrad.) Chev., *Hypodermella ampla* (Davis) Dearn. and *Asterina pinastri* Sacc. and Ell. were quite common on the needles examined. However, in order to obtain more information on the cause of this damage and the development of the disease, 448 trees were numbered and examined in 14 sample plots. From 15 to 35 per cent of the needles were affected with an average of 21.5 per cent. Usually the injury was greater at the base of the crown than

at the top. It should also be mentioned that such a condition occurred in the general infestation area of the jack-pine sawfly (*Neodiprion swainei* Midd.).

Spruce Needle Rust.—A severe infection of *Chrysomyxa ledi* (A. & S.) de Bary on white spruce was reported from Abitibi County. In Laurentide Park and in Abitibi, aecia of *Chrysomyxa ledicola* (Peck) Lagerh. were very common on black spruce needles.

Cytospora Canker of Blue Spruce.—This disease, caused by *Cytospora kunzei* Sacc., was destructive to branches of Colorado blue spruce trees at a number of locations.

Ink Spot of Aspen.—This foliage disease caused by *Ciborinia whetzelii* (Seaver) Seaver, has been reported from all parts of the Province in 1956. The cool wet weather which prevailed during the spring and early summer was probably responsible for this outbreak.

Winter Drought.—During the spring and early summer, foliage browning followed by needle drop was observed commonly and frequently reported to the laboratory from various parts of the Province. This discoloration was particularly striking on cedar hedges along roads or on ornamental spruce and pine trees near buildings. This type of injury which has occurred occasionally in the past, is typical of winter drought. Such symptoms are commonly observed after a mild winter with a thin layer of snow.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Aspen, trembling	*Napicladium tremulae* (Frank) Sacc.	Ancienne-Lorette	Shoot blight.
Butternut	*Melanconis juglandis* (E. & E.) Graves	Cap Rouge	Causes dieback of branches.
Fir, balsam	*Uredinopsis* sp.	Laurentide Park, Rivière à Pierre	Needle rust.
	Hypodermella mirabilis Darker	Laurentide Park	Associated with *H. nervata.*
	Phacidium infestans Karst.	Laurentide Park, North Shore, Mont-Laurier, La Vérendrye Park	Snow blight, very common and often destructive in young stands.
	Trichosphaeria parasitica Hartig	La Vérendrye Park, North Shore, Laurentide Park	Needle blight, apparently more common than expected. Seems to be widely distributed.
	Phacidium sp.	Laurentide Park, North Shore, La Vérendrye Park, Abitibi	Causing twig blight. Frequent in the Province.
Pine, jack	*Cronartium coleosporioides* (D. & H.) Arth.	Lower St. Maurice, Abitibi	Western gall rust.
	Cronartium comptoniae Arth.	Upper St. Maurice	Sweetfern blister rust.
Spruce, blue	*Ascochyta piniperda* Lindau	Quebec area	Causing needle blight.
	Chrysomyxa ledicola (Peck) Lagerh.	Lake St. John	Needle rust.
Spruce, red	*Trichosphaeria parasitica* Hartig	North Shore	Needle blight.
Spruce, white	*Lophodermium piceae* (Fuckel) v. Höhnel	Laurentide Park	Needle cast.
Willow	*Fusicladium saliciperdum* (All. & Tub.) Lind.	North of Montreal, Charlevoix, North Shore	Causing willow blight. Destructive in many areas in 1956.

PROVINCE OF ONTARIO

FOREST INSECT SURVEY

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INTRODUCTION

Numerous insect pests threatened the natural forests and plantations of Ontario in 1956. Recent heavy host-tree mortality resulting from repeated destruction of new foliage by the spruce budworm has occurred within a total area of approximately 6,000 square miles, an increase of roughly 2,000 square miles over 1955. A decline in the intensity in the Sioux Lookout District was offset by major eastward extensions of infestation in the Kenora, Fort Frances, and Geraldton districts. Defoliation by the larch sawfly decreased in the Kapuskasing District but elsewhere throughout Ontario it maintained about the same level as in 1955. New incipient infestations of the forest tent caterpillar appeared in a relatively small area of western Ontario in 1956 and are expected to cause defoliation of broad-leaved trees over a larger area in 1957. Two new infestations of the pine root-collar weevil were discovered, one near Pembroke, and the other in Lake Simcoe District. A decline in the severity of damage by the European pine shoot moth was evident in southern Ontario. High population levels of two other insects developed during the summer drought of 1955 causing considerable damage which became apparent in 1956. Extensive mortality of jack pine was caused by the pine tortoise scale in northern Ontario and the pine engraver beetle caused tree mortality in many pine plantations in southern Ontario.

Collections of the forest insects *Gnophothrips piniphilus* Cwfd. (Thysonoptera), a new Canadian record; *Argyresthia laricella* Kft.; *Ocnerostoma piniariella* Zell. (Yponomeutidae); and *Gracillaria fraxinella* Ely (Gracillariidae); all extremely rare Ontario records, highlighted the general collecting program of 1956.

Technical studies within the Forest Insect Survey in 1956 included a life history study on a pine bud moth, work on the life history and description of the mature larva of various tortricids affecting pine, studies on the parasites of the forest tent caterpillar and European pine shoot moth, and a morphological study on the larva of Swaine's sawfly.

A total of 8,894 insect collections was received at the Forest Insect Laboratory, Sault Ste. Marie, in 1956, an increase of 2,787 over 1955. The assistance provided by employees of the Ontario Department of Lands and Forests, by personnel of woods-operating companies, and by other co-operators is acknowledged and greatly appreciated. The distribution of these collections among the principal tree species was as follows:

Coniferous trees	Collections		Broad-leaved trees	Collections	
Pine—			Poplar—		
Jack pine	1,386		Trembling aspen	925	
Red pine	335		Balsam poplar	120	
Scots pine	204		Largetooth aspen	37	
White pine	128		Miscellaneous poplars	34	
Miscellaneous pines	17				1,116
		2,070			
Larch		973	Birch—		
			White birch	696	
Spruce—			Yellow birch	13	
White spruce	594		Miscellaneous birches	31	
Black spruce	221				740
Miscellaneous spruces	53		Cherry		545
		868			

Coniferous trees	Collections		Broad-leaf trees	Collections	
Balsam fir		462	Alder		356
Cedar—			Willow		321
Eastern white cedar	88		Maple—		
Northern red cedar	1		Red maple	208	
Miscellaneous cedars	9		Sugar maple	82	
		98	Miscellaneous maples	45	
Hemlock		22			335
Other coniferous trees		1	Elm		231
Total		4,494	Oak—		
Miscellaneous hosts or host unspecified		89	Red oak	84	
			White oak	98	
			Miscellaneous oaks	15	
					197
			Walnut, butternut, hickory		69
			Ash		159
			Basswood		39
			Miscellaneous broad-leaved trees		203
			Total		4,311

Grand Total..... 8,894

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—Noteworthy changes in the extent and intensity of spruce budworm infestations and in host-tree mortality in 1956 were as follows: (a) heavy infestations in the north half of the Western Region showed marked declines, whereas heavy infestations in the south half persisted and spread eastwards; (b) in the Mid-western Region, a collapse of infestations in the northern part of the Black Bay Peninsula and eastward extensions of heavy infestations in the Geraldton District resulted in little change in the total area affected; (c) population levels declined in the Kapuskasing and Cochrane districts; (d) considerable extensions in areas of heavy host-tree mortality totalling approximately 2,000 square miles occurred east of Red Lake in the Sioux Lookout District and south through Eagle Lake in the Kenora District. Areas of infestation and of heavy host-tree mortality are delineated on accompanying maps.

Infestations in the north-central part of the Kenora District and in the Sioux Lookout District declined from heavy intensity in 1955 to light in 1956. The area affected extended from Eagle Lake in the Kenora District northward through the Sioux Lookout District to Trout Lake and from Sydney Lake eastward to Sturgeon Lake. Within this extensive area two sizable heavy infestations persisted at the eastern extremity of Lac Seul. Two major eastward extensions of the heavy infestation in the Kenora and Fort Frances districts occurred in 1956. The broad band of heavy infestation which was present along the Fort Frances-Kenora district boundary north of Sawbill Lake in 1955 extended northeast to the vicinity of Norway and Upper Scotch lakes. A medium infestation adjoined this area and extended eastward into Pyramid Township in Port Arthur District. The second extension was located in Quetico Park, Fort Frances District, where a wide band of heavy infestation developed eastward from Cirrus and Turner lakes to Pickerel and Kawnipi lakes.

Eight years of heavy defoliation on the Black Bay Peninsula in the Port Arthur District has culminated in heavy host-tree mortality and the collapse of infestations on the upper half of the peninsula in 1956. On Isle St. Ignace and Simpson Island east of this peninsula population levels greatly increased resulting

in light-to-heavy infestation. Northward in the Geraldton District the heavy infestation which originated in the Pays Plat area in 1953 and spread northward and eastward each year since that time extended approximately 20 miles farther east to the Steel River. A residual pocket of the old Nipigon outbreak of the 1940's which had persisted in the vicinity of Disraeli and Little Sturge lakes for several years finally disappeared in 1956.

In the Northern Region, population declines were most apparent in infestations centered in Boyce Township in the western part of the Kapuskasing District and south of Smooth Rock Falls along the Kapuskasing-Cochrane district boundary. At the former, infestation intensity declined from heavy in 1955 to light in 1956 and few larvae could be found in the latter area. The Rogers-Studholme infestation which declined to light intensity in 1955 showed further decline in 1956.

For the fourth consecutive year a stand of white spruce in the Uxbridge Forest, Lake Simcoe District, suffered severe defoliation of the current year's foliage. Also in southern Ontario, a light infestation of spruce budworm occurred on mature white spruce and balsam fir trees in a 4-acre woodlot in Adamston Township, Tweed District.

Chapleau	1	Pembroke	3
Cochrane	2	Port Arthur	14
Fort Frances	40	Rideau	2
Geraldton	59	Sault Ste. Marie	2
Gogama	1	Sioux Lookout	42
Kapuskasing	13	Sudbury	4
Kenora	48	Swastika	1
Lake Simcoe	1	Tweed	5
North Bay	1	White River	2

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—Less-pronounced changes in the distribution and intensity of larch sawfly infestations were evident in 1956 than in past years. Infestations remained at a low level in northwestern Ontario, declined in north-central Ontario, and tended to increase in intensity to the east and south.

In the Western Region, populations remained at a low level in the Kenora and Sioux Lookout districts for the third consecutive year. As in 1955, moderate to heavy infestations occurred in the western part of the Fort Frances District. In parts of the Port Arthur, Geraldton, and Kapuskasing districts infestations declined to light and medium intensities. The majority of larch stands in the central part of Ontario from Lake Superior east to the Ontario-Quebec boundary suffered moderate to severe defoliation. Most infestations south of the French River were of light intensity in 1956.

Chapleau	60	North Bay	37
Cochrane	51	Parry Sound	27
Fort Frances	31	Pembroke	29
Geraldton	40	Port Arthur	37
Gogama	56	Rideau	18
Kapuskasing	34	Sault Ste. Marie	77
Kenora	37	Sioux Lookout	20
Lake Erie	1	Sudbury	37
Lake Huron	14	Swastika	40
Lake Simcoe	28	Tweed	22
Lindsay	23	White River	69

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—A remnant of the outbreak which originated in central Canada in 1948 and began to decline in 1953, persisted in 1956 in the northeastern part of the Province. Medium-to-heavy infestations were reported in the southeastern part of the Cochrane Dis-

trict, and through the central part of the Swastika District into the northeastern section of North Bay District. An area of light infestation adjoined these infestations in the Gogama District. Farther west in the Chapleau District, small areas of light infestation were observed in Township 46, Panet Township, and in the Missinabie Lake area.

During the past 3 years infestations have developed along the Albany River in the northern part of the Sioux Lookout District, presumably from sparse populations which escaped the effects of the unfavorable spring weather in 1953. Two areas of heavy infestation were mapped south of Lake St. Joseph in the Sioux Lookout District comprising a total area of approximately 375 square miles. Five smaller pockets of heavy infestation occurred in the vicinity of Lake St. Joseph. The areas of infestation described above are shown on the accompanying map.

The number and species of parasites which attacked this insect and the sex ratio of the emerging moths in the Sioux Lookout District in 1956 were similar to those recorded at the beginning of the past outbreak. Egg-band counts made in September and October indicated that infestations will occur over a much larger area in 1957 than in 1956.

In northeastern Ontario, populations of *M. disstria* were typical of old infestations except that egg-band counts were higher than anticipated. Accordingly, pockets of heavy infestation are forecast for 1957 in the area around Nighthawk Lake in the Cochrane District; in the Matachewan, Kirkland Lake, and Virginiatown areas in the Swastika District; and around Cobalt and Haileybury in the North Bay District.

Chapleau	7	North Bay	19
Cochrane	30	Parry Sound	1
Fort Frances	2	Rideau	2
Geraldton	5	Sioux Lookout	13
Gogama	12	Swastika	103
Kapuskasing	3	White River	5
Kenora	3		

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.).—Little change in the distribution of this insect has been observed in southern Ontario since 1948. High mortality of overwintering larvae occurred in several areas resulting in greatly reduced bud damage compared with recent years. In most localities, however, sufficient larvae survived to infest pine plantings late in the summer of 1956.

Lake Erie	13	Lindsay	22
Lake Huron	20	Parry Sound	1
Lake Simcoe	25	Tweed	3

Pine Tortoise Scale, *Toumeyella numismaticum* P. & M.—Considerable mortality of jack-pine trees was caused by this insect at numerous points in northern Ontario in 1956. Jack-pine stands within an area of approximately 300 square miles in the northwestern part of Division 34, Port Arthur District, and adjacent stands in the Sioux Lookout District were severely damaged. Similar conditions were observed along the headwaters of the Batchawana River in the Sault Ste. Marie District and in Township 11B south of Kormac in the Chapleau District. Tree mortality occurred most commonly in narrow bands or pockets along rivers and lakes. Wherever dead trees were examined critically, shoestring root rot, by *Armillaria mellea* (Vahl ex Fries) Quel. was present.

Infestations of this scale become apparent in inaccessible areas only after host tree mortality commences. Consequently the damage reported above resulted from infestations which occurred in 1955 and in the spring of 1956. In

all instances where damage has been detected from the air and the trees examined on the ground during the summer of 1956, very few, if any, scales were found. Natural control is usually brought about by unfavorable weather in combination with predation by the lady-bird beetle, *Hyperaspis binotata* Say.

Chapleau	4	Port Arthur	6
Fort Frances	2	Rideau	1
Kenora	4	Sault Ste. Marie	1
North Bay	2	Sioux Lookout	3
Parry Sound	4	Swastika	1

European Pine Sawfly, *Neodiprion sertifer* (Geoff.).—Minor extensions in the known range of distribution of this introduced sawfly in southwestern Ontario were apparent in 1956. These were noted northwest of Owen Sound in Bruce County, in the central part of Dufferin County, and southeast of Simcoe in Norfolk County. Infestations prevailed in pine plantations in southwestern Ontario west of a line extending from Keppel Township at the base of the Bruce Peninsula southward through Priceville, Shelbourne, Guelph, and Caledonia to Simcoe in Norfolk County.

There was a distinct increase in infestation intensity in many plantations which have been infested for two or more years. This was particularly noticeable in Huron County where most Scots pine plantations suffered severe damage. Plantations in MacGillivray, Delaware, Aldborough, and Rommey townships in Lake Erie District were also defoliated. Although damage was much less serious in the western part of Lake Simcoe District where infestations occurred commonly for the first time in 1955, population levels increased considerably.

Lake Erie	20	Lake Simcoe	6
Lake Huron	72		

Red-headed Pine Sawfly, *Neodiprion lecontei* (Fitch).—This insect was more abundant in the south-central and southeastern regions than in 1955. Pine plantations along Highway 11 in the Gravenhurst-Bracebridge area suffered moderate to heavy defoliation with up to 33 per cent tree mortality in some plantings. Light mortality of red pine occurred in Hagerman Township, Parry Sound District, where a heavy infestation persisted for the second year. In the Pembroke District heavy infestations were observed on roadside plantings in Ross and Rolph townships. Plantations in Maria and Westmeath townships along the Ottawa River and in the vicinity of Barry's Bay were moderately defoliated. A medium infestation occurred in Dunnet Township in the North Bay District. Among the numerous infestations which occurred in the Lindsay and Rideau districts, the most severe were in the Victoria, Limerick, and Leeds county forests.

Population levels were generally low in the Lake Simcoe and Sudbury districts as in 1955. However, in the former district a compartment of western yellow pine seedlings was severely infested and in the Sudbury District about one-half of the red pine trees in a plantation in Hallam Township were moderately infested. Small numbers of colonies were found in the Lake Huron and Sault Ste. Marie districts in 1956.

Lake Huron	15	Pembroke	21
Lake Simcoe	10	Rideau	13
Lindsay	22	Sault Ste. Marie	10
North Bay	15	Sudbury	9
Parry Sound	24	Tweed	12

Green-striped Mapleworm, *Anisota rubicunda* F.—Defoliation of red maple by this insect was observed commonly throughout central Ontario in 1956. As in 1955, infestations were heavy between Martin River and Merrick

Township in the Temagami-Lady Evelyn lakes area, North Bay District, and in Cameron and Clara townships in the Pembroke District. Infestations increased to heavy intensity in 1956 in five townships south of Sudbury and in two areas in the North Bay District, namely Janes and Crerar townships and in Gillies Limit Township. Medium or light infestations occurred in the central part of the Sudbury District, in Robinson Township on Manitoulin Island, in six townships in the southeastern part of the Gogama District, in the central and southern parts of the Parry Sound District, in several townships along the Ottawa River in the Pembroke District, and in the Fort Frances District near Sandpoint Lake and Lac La Croix.

Chapleau	1	Parry Sound	12
Fort Frances	2	Pembroke	21
Gogama	10	Sault Ste. Marie	23
Lake Erie	3	Sudbury	30
Lake Huron	2	Swastika	5
Lindsay	1	Tweed	1
North Bay	45		

Orange-striped Oakworm, *Anisota senatoria.* (J. E. Smith)—White and red oak trees were lightly infested at numerous points in the Lake Erie District. The light infestation in the Grand Bend area persisted at approximately the same level as in 1955. Infestations northwest of Kingston in the Lindsay District declined to a low level in 1956 whereas scattered white oak trees north of Deseronto in the Tweed District suffered medium-to-heavy defoliation.

Lake Erie	20	Tweed	1
Lindsay	3		

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.).—Considerable heavy defoliation of aspen was caused by this insect in northern Ontario in 1956. Pockets of heavy infestation occurred near Whitewater and Savant lakes in the Sioux Lookout District, near Manitowadge and Burroughs lakes in the Geraldton District, and in six townships in the western part of the Sault Ste. Marie District.

Chapleau	6	Sault Ste. Marie	17
Geraldton	18	Sioux Lookout	1
Gogama	3	Sudbury	7
Kapuskasing	2	Swastika	1
Lake Simcoe	3	White River	4

Spruce Bud Moth, *Zeiraphera ratzeburgiana* Sax.—Heavy infestations of this small budworm occurred on open-grown white spruce trees in three townships in the Port Arthur area, east of Rossport in Geraldton District, and along the Mississagi River east of Iron Bridge in Sault Ste. Marie District. A medium infestation was observed near Elsas in the Gogama District.

Geraldton	1	Sault Ste. Marie	1
Gogama	1	Sudbury	3
Kenora	1	Swastika	1
Port Arthur	10	White River	1

Jack-pine Budworm, *Choristoneura pinus* Free.—Several small areas of light infestation occurred in the Kenora and Sioux Lookout districts where population levels have declined since 1954. In the Fort Frances District an increase in the abundance of this insect was noted at widely-separated locations.

Chapleau	1	Port Arthur	2
Fort Frances	8	Sault Ste. Marie	2
Kenora	6	Sioux Lookout	4
Lake Simcoe	1		

Orange-Humped Oakworm, *Symnerista canicosta* Francl.—This insect caused heavy defoliation of white oak trees along the shore of Georgian Bay from Port Severn to Honey Harbour and light defoliation along the Severn River in the extreme northern part of the Lake Simcoe District in 1956.

Lake Erie	1	Parry Sound	1
Lake Simcoe	11	Sault Ste. Marie	1
Lindsay	3	Tweed	3

Black-headed Budworm, *Acleris variana* (Fern.).—In spite of the numerous beating samples taken from spruce in 1956, few larvae of this insect were found.

Lake Huron	1	Port Arthur	2
Parry Sound	1	Swastika	1

Yellow-necked Caterpillar, *Datana ministra* (Drury).—This caterpillar was found commonly in the South-central and Southeastern regions in 1956. Heavy infestations were found on hawthorn, white birch, and elm trees south of Pembroke, and light infestations occurred at numerous points elsewhere in the above regions.

Fort Frances	1	Pembroke	13
Gogama	1	Rideau	5
Lake Erie	14	Sault Ste. Marie	5
Lake Huron	1	Sioux Lookout	1
Lake Simcoe	3	Sudbury	1
Lindsay	4	Swastika	1
Parry Sound	4	Tweed	1

Walnut Caterpillar, *Datana integerrima* G. & R.—There was a decline in the abundance of this insect on walnut in southern Ontario in 1956 compared with recent years. Heavy infestations were restricted to parts of Waterloo, Brant, and Oxford counties in the Lake Huron District and to the southern part of the Lake Simcoe and Lake Erie districts.

Lake Erie	25	Lindsay	1
Lake Huron	17	Tweed	1

Basswood Looper, *Erannis tiliaria* (Harr.).—This marks the second year of very low population levels of this insect. Small numbers of larvae were observed in the Sault Ste. Marie, Parry Sound, and Lake Erie districts and in the Southeastern Region.

Gogama	1	Rideau	1
Lake Simcoe	1	Sault Ste. Marie	3
Lindsay	5	Tweed	1
Parry Sound	1		

Spring Cankerworm, *Paleacrita vernata* (Peck).—Infestations persisted on elm trees in the Lake Simcoe, Lake Huron, and Lindsay districts but populations declined in some areas compared with 1955. Little change was noted in the persistent infestation which has been reported for the past seven years near Craighurst in Lake Simcoe District. Infestations in Wentworth County, Lake Huron District, and west of Norwood, Lindsay District declined sharply in 1956.

Lake Huron	4	Lindsay	2
Lake Simcoe	2		

Fall Cankerworm, *Alsophila pometaria* (Harr.).—There was a general decline in the infestations reported in southern Ontario in 1955 but three new infestations occurred in 1956. In the Lake Huron District moderate to severe

defoliation of elm trees occurred in a 5-acre woodlot near Campbellville and along the county road between Milton and Campbellville. A heavy infestation was also observed in Horton Township, Tweed District.

In the Western Region, population levels increased near Fort Frances where Manitoba maple, basswood, and elm trees suffered light to heavy defoliation. A light infestation persisted for the second year in the town of Kenora.

Fort Frances	4	Rideau	1
Kenora	1	Tweed	2
Lindsay	1		

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.).—No infestations of this looper were reported in Ontario in 1956. Mortality of hemlock trees on Bernice Island in the Parry Sound District, which had been heavily infested before the application of an insecticide in 1955, increased in 1956 to approximately 90 per cent.

Cochrane	1	Parry Sound	10
Lake Huron	1	Pembroke	3
Lake Simcoe	4	Sault Ste. Marie	1
North Bay	3	Sioux Lookout	1

Fall Webworm, *Hyphantria cunea* (Drury) (formerly referred to as *Hyphantria textor* Harr.).—Surveys carried out during the past ten years have shown that population levels of this webworm reached a peak in 1949, declined in 1950 and 1951, remained low for the next three years. In 1955 there was a significant increase in population levels and in 1956 light infestations were observed commonly in numerous areas of the Province.

Chapleau	17	Parry Sound	19
Cochrane	15	Pembroke	24
Fort Frances	27	Port Arthur	11
Gogama	26	Rideau	36
Kenora	14	Sault Ste. Marie	51
Lake Erie	21	Sioux Lookout	6
Lake Huron	24	Sudbury	23
Lake Simcoe	21	Swastika	18
Lindsay	19	Tweed	22
North Bay	30	White River	3

Eastern Tent Caterpillar, *Malacosoma americanum* (F.).—Populations of this insect declined in 1956 to the lowest level observed in recent years. Except for a few small pockets of light infestation, only occasional tents were observed at widely-separated points throughout its range in Ontario.

Lake Erie	9	Pembroke	13
Lake Huron	11	Rideau	6
Lake Simcoe	5	Sudbury	8
Lindsay	9	Tweed	8
Parry Sound	16		

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar).—Population levels of this insect were very low in all districts within its range in northern Ontario except in parts of the Chapleau, Gogama, Swastika, and Cochrane districts where tents were common. Two light infestations were reported; one on willow in Delora Township, Cochrane District, and another on willow and alder in Beatty Township, Swastika District.

Chapleau	12	North Bay	3
Cochrane	26	Port Arthur	1
Geraldton	5	Sudbury	3
Gogama	17	Swastika	34
Lake Simcoe	1	White River	5

Balsam Fir Sawfly, *Neodiprion abietis* complex.—For the second year population levels of this sawfly declined in the Central and South-central regions. Relatively few larval colonies were observed in 1956 in the southern part of the Central Region and in the North Bay District where infestations had occurred for several years. In contrast, larval colonies were observed commonly on open-grown balsam fir trees in the western part of the Fort Frances District and moderate infestations occurred west of Kenora. In southern Ontario pockets of moderate to heavy infestation were observed along the west side of Bruce Peninsula and at numerous points in the Tweed and Rideau districts.

Chapleau	2	Lindsay	2
Fort Frances	10	Parry Sound	2
Geraldton	13	Pembroke	12
Gogama	10	Port Arthur	1
Kapuskasing	1	Rideau	9
Kenora	5	Sioux Lookout	4
Lake Huron	12	Tweed	6
Lake Simcoe	3	White River	9

Red-pine Sawfly, *Neodiprion nanulus nanulus* Schedl.—After increasing for three consecutive years, populations of this insect levelled off or declined in northern Ontario. Pockets of heavy infestation persisted at White Otter and Eye lakes in the Kenora District. Infestations in Robson and Golding townships in the western part of Port Arthur District declined from heavy intensity in 1955 to medium in 1956. Population levels were generally low in the Central and South-central regions.

Chapleau	15	Pembroke	2
Fort Frances	27	Port Arthur	47
Geraldton	11	Rideau	1
Kenora	42	Sioux Lookout	34
North Bay	4	Tweed	1
Parry Sound	2	White River	17

Black-headed Jack-pine Sawfly, *Neodiprion pratti banksianae* Roh.—Collections of this sawfly were made in 18 forest districts in 1956. In most instances infestations were confined to single or small groups of trees, the only exception being in Bronson and Petawawa townships in the Pembroke District where a moderate to heavy infestation has persisted in sizeable stands of jack pine for the fourth consecutive year. Here, the upper third of the crowns of overstory as well as understory and small open-grown trees suffered almost complete defoliation of the old foliage.

Elsewhere in the Province small pockets of medium to heavy infestation occurred at Pakagoning Lake, Kenora District; at Vista and Pickerel lakes, Fort Frances District; in Loudon Township, North Bay District; in Humphrey Township, Parry Sound District; and along Highway 11 south of Orillia, Lake Simcoe District. Heavy infestations which were reported in 1955 in the Sudbury, Tweed and Lake Huron Districts declined sharply in 1956.

Chapleau	21	North Bay	5
Cochrane	3	Parry Sound	10
Fort Frances	25	Pembroke	17
Geraldton	23	Port Arthur	2
Gogama	8	Rideau	5
Kapuskasing	2	Sioux Lookout	9
Kenora	35	Sudbury	4
Lake Huron	5	Tweed	5
Lake Simcoe	4	White River	7

Swaine Jack-pine Sawfly, *Neodiprion swainei* Midd.—Infestations of this sawfly were restricted to the central part of Ontario in 1956. Small pockets of heavy infestation occurred in Somme Township, Gogama District and on two small

islands; one in Banks Lake in Banks Township, Swastika District, and a second in Rabbit Lake, in the North Bay District. Medium infestations were reported in Noble Township, Gogama District, and in the Banks Lake area, on the Swastika-North Bay district boundary. Small areas of light infestation occurred in the Sault Ste. Marie and Chapleau districts. Small numbers of colonies were observed in western Ontario. Extensive infestations which have persisted in the Temagami-Lady Evelyn lakes area of the North Bay District for many years declined from medium to heavy in 1955 to light intensity in 1956.

Chapleau	8	Parry Sound	1
Fort Frances	30	Sault Ste. Marie	14
Gogama	21	Sudbury	7
Kenora	1	Swastika	5
North Bay	25		

Red-headed Jack-pine Sawfly, *Neodiprion virginianus* complex.—As in 1955, colonies of this sawfly were widely distributed with localized areas of medium to heavy infestation reported from several forest districts in northern Ontario. Heavy infestations persisted in Richardson Township, Fort Frances District, and near Kakabeka Falls north of Port Arthur. New medium to heavy infestations were detected along Highway 17 in townships 88 and 89 in the Geraldton District, in a 10-acre stand of young jack pine at Distant Lake in the Sault Ste. Marie District, in Township 9 in the Chapleau District, and east of Lowbush in the Cochrane District.

Chapleau	14	Parry Sound	3
Cochrane	7	Port Arthur	33
Fort Frances	14	Sault Ste. Marie	12
Geraldton	5	Sioux Lookout	7
Gogama	22	Sudbury	7
Kapuskasing	9	Swastika	8
Kenora	8	Tweed	1
Lake Simcoe	1	White River	2
North Bay	10		

Introduced Pine Sawfly, *Diprion similis* (Htg.).—Small numbers of larvae were found in 1956 within its known range of distribution in the Lake Huron and Lake Simcoe districts.

Lake Huron	2	Lake Simcoe	1

European Spruce Sawfly, *Diprion hercyniae* (Htg.).—The presence of this sawfly in the Geraldton District was verified in 1956 when one larva was collected near Terrace Bay. This collection and one made near Nakina in 1954 represent the most westerly records of this insect in Ontario except for the Fort Frances records which have been reported in past years and which probably represent extensions from south of the Great Lakes.

Little change occurred in the numbers of larvae collected in beating samples in 1956. A minor extension of the light infestation centered in Kirkwood Township, Sault Ste. Marie district, was observed.

Fort Frances	11	Parry Sound	20
Geraldton	1	Pembroke	14
Lake Huron	3	Rideau	9
Lake Simcoe	6	Sault Ste. Marie	25
Lindsay	13	Swastika	5
North Bay	13	Tweed	14

Birch Sawfly, *Arge pectoralis* (Leach).—A marked decline in the infestation intensity of this sawfly in northeastern Ontario became evident in 1956. The heavy infestations which occurred in the Chapleau, Gogama, Cochrane, and

North Bay districts in 1955 declined to light intensity. Small numbers of white birch trees were moderately defoliated in the southern part of Cochrane District and at several points in Pembroke District.

Chapleau	5	North Bay	8
Cochrane	35	Parry Sound	3
Geraldton	2	Pembroke	5
Gogama	20	Sault Ste. Marie	2
Kapuskasing	1	Sudbury	2
Lake Huron	17	Swastika	38
Lindsay	2	Tweed	1

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.).—As in former years small pockets of infestation occurred on white and black spruce at many points. Generally speaking infestations were light in the Central and Mid-western forest regions. Small numbers of trees were heavily infested at widely-separated points in the Western and Northern regions and in southern Ontario.

Chapleau	14	Parry Sound	17
Cochrane	23	Pembroke	16
Fort Frances	7	Port Arthur	26
Geraldton	9	Rideau	28
Gogama	7	Sault Ste. Marie	9
Kapuskasing	8	Sioux Lookout	5
Kenora	6	Sudbury	2
Lake Huron	9	Swastika	15
Lake Simcoe	9	Tweed	18
Lindsay	16	White River	32
North Bay	15		

Smaller European Elm Bark Beetle, *Scolytus multistriatus* (Marsh.).—Before 1956 this introduced bark beetle had been recorded from the following counties in southwestern Ontario: Essex, Kent, Lambton, Elgin, Middlesex, Haldimand, and Welland. Two counties were added to this distribution list in 1956, namely Norfolk County where old damage was observed at two locations and Halton County in the Lake Huron District where adult beetles were collected from trap logs.

Lake Erie	2	Lake Huron	1

Pine Root-collar Weevil, *Hylobius radicis* Buch.—Little change was noted in the status of this insect in Simcoe County, Lake Simcoe District, in 1956. Mortality of Scots pine continued in infested plantations and one new infestation was recorded in Tiny Township near Perkinsfield.

Elsewhere, in addition to the small infestation in Parke Township, Sault Ste. Marie District, reported in 1955, a new infestation was detected in a mixed plantation of Scots and red pine in Petawawa Township, Pembroke District. Small numbers of Scots pine were dead or in a dying condition.

Pembroke	1

Weevil Damage to Pine, *Pissodes approximatus* Hopk.—Large numbers of adult weevils, in some instances with *Hylobius pales* Hbst., emerged from slash, stumps, and felled trees at numerous points in southern Ontario following selective cutting of Scots pine. The beetles caused considerable mortality of new plantings and small trees by removing bark from the branches. Weevils caused branch killing on larger trees in numerous plantations in Tiny Township, Lake Simcoe District, and in several plantations in Norfolk County, Lake Erie District.

Lake Erie	1	Parry Sound	1
Lake Huron	2	Pembroke	1
Lake Simcoe	5	Rideau	1

Tortricids on Young Coniferous Plantations in Southern Ontario.—At least five species of tortricids caused serious damage to young plantations of Scots pine, white pine, jack pine, and white spruce in the Lindsay, Lake Simcoe, and Lake Huron districts. The commonest species were *Tortrix alleniana* Fern., and *Tortrix pallorana* Rob., but *Sparganothis sulfureana* Clem., *Sparganothis unifasciana* Clem., and *Archips rosaceana* Harr. were found in small numbers. These insects live on herbaceous ground cover plants most of the year, but ascend trees under 3 feet in height in May and June and feed on the new buds. They kill or injure the leaders and cause serious deformities.

Pine Spittle Bug, *Aphrophora parallela* (Say).—This pest of Scots, jack and white pine has caused extensive damage to plantations in the Southwestern Region for several years. Trees which are heavily attacked have discolored brown foliage and a stunted appearance. Moderate to heavy infestations have built up in many plantations in Grey, Waterloo, Lincoln, and Middlesex counties in the Lake Huron and Lake Erie districts and in the Vivian and Uxbridge forests in the Lake Simcoe District. Moderate damage by this insect was reported in Townships 11B and 10C in the Chapleau District in 1956.

Chapleau	31	Parry Sound	2
Geraldton	4	Pembroke	4
Gogama	17	Port Arthur	7
Kapuskasing	1	Sudbury	1
Lake Erie	5	Swastika	6
Lake Huron	1	White River	1
Lake Simcoe	2		

Pine Engraver, *Ips pini* Say.—Tree mortality caused by the attack of this bark beetle in 1955 became apparent in white, red, and Scots pine plantations in 1956. Pockets of infestation were detected in Norfolk, Elgin, and Middlesex counties in Lake Erie District, and in Brant and Halton counties in Lake Huron District. In Nassagaweya Township, in Halton County, almost one-third of the trees in a plantation of 400 red pines were killed. Patches of mortality totalling approximately 8 acres were mapped from a helicopter in the Victoria Forest, Lindsay District. In 1955, damage in the Lake Simcoe District was heaviest in the Holly Tract, Innisfil Township, and in a compartment of the Midhurst Nursery. In the same year thinning operations in the Nairn and Kirkwood plantations in the Sudbury and Sault Ste. Marie districts respectively caused a marked increase in numbers of these beetles.

Previous outbreaks of this potentially dangerous insect have been associated with years of severe drought and it is presumed that abnormally low precipitation during the summer of 1955 may have created favorable conditions.

Collections in 1955 and 1956

Chapleau	1	Lindsay	2
Gogama	2	North Bay	3
Lake Erie	1	Sault Ste. Marie	1
Lake Huron	1	Sudbury	1
Lake Simcoe	2		

Jack-pine Shoot Moth, *Eucosma sonomana* Kft.—Initial surveys to determine the distribution of this shoot borer were carried out in 1955 and continued in 1956. To date the insect has been found in all three districts of the Western Region and in Sault Ste. Marie, Chapleau, Gogama, and Parry Sound districts. Damage was confined to jack pine trees in small diameter classes on the periphery of large stands. The leading shoot is favored and consequently repeated attacks cause serious growth malformations. The insect was most

abundant in Meglund Township, Kenora District, and in Westbrook and Garvey townships, Gogama District.

Chapleau	1	Parry Sound	1
Fort Frances	4	Sault Ste. Marie	8
Gogama	4	Sioux Lookout	7
Kenora	7		

A Spider Mite, *Oligonychus* sp.—This pest which is scarcely visible to the naked eye caused conspicuous discoloration and premature needle drop of open-grown jack pine trees in the North Bay and Parry Sound districts in 1956. Heaviest damage was found on islands in South Bay of Lake Nipissing.

North Bay	12	Sault Ste. Marie	1
Parry Sound	2	Sioux Lookout	2
Port Arthur	2	Sudbury	1

Walkingstick, *Diapheromera femorata* (Say).—No heavy infestations of this insect were reported in 1956. A light infestation occurred on oak trees at Grand Bend in the Lake Erie District.

Lake Erie	2

A Leaf Miner on Birch, *Profenusa alumna* (MacG.).—As in 1955, infestations of this sawfly were widely distributed in northern and central Ontario. Medium to heavy infestations persisted between Chippewa Falls and the Montreal River in the Sault Ste. Marie District and in Ivanhoe Township, Gogama District, but infestations in the Chapleau and Parry Sound districts declined to light intensity. A new heavy infestation appeared on Bruce Peninsula in the Lake Huron District.

Chapleau	12	Parry Sound	4
Cochrane	1	Pembroke	3
Gogama	16	Sault Ste. Marie	21
Kapuskasing	3	Sudbury	4
Lake Erie	1	Swastika	16
Lake Huron	5	Tweed	1
North Bay	16	White River	3

Aspen Blotch Miner, *Lithocolletis salicifoliella* Chamb.—This leaf miner increased in numbers in trembling aspen stands in the Western Region for the third consecutive year. Moderate to heavy browning of foliage was observed in 1956 at numerous points in the Fort Frances, Kenora, and Sioux Lookout districts and in the western part of Port Arthur District.

Elsewhere in the Province localized heavy infestations occurred in Rennie Township, Chapleau District and in the eastern part of the Pembroke District.

Chapleau	2	North Bay	1
Fort Frances	20	Pembroke	8
Geraldton	3	Port Arthur	15
Gogama	1	Sioux Lookout	23
Kapuskasing	13	White River	18
Kenora	27		

Solitary Oak Leaf Miner, *Lithocolletis hamadryadella* (Clem.).—A heavy infestation of this leaf miner was observed on white and red oak trees in a 3-square-mile area in Bosanquet Township, Lambton County. Mining was most severe in the lower crowns of mature trees and on young saplings. Medium infestations were noted in Norfolk and Middlesex counties, in the Lake Erie District.

Lake Erie	6	Rideau	4
Lindsay	3	Sault Ste. Marie	2
Parry Sound	1	Tweed	2

Birch Leaf Mining Sawfly, *Heterarthrus nemoratus* (Fall.).—Heavy infestations of this species persisted in white birch stands for the second year on the Bruce Peninsula, Lake Huron District. Small numbers of larvae were collected in the Sault Ste. Marie and Pembroke districts.

Lake Huron	6	Sault Ste. Marie	6
Pembroke	1		

Birch Leaf Miner, *Fenusa pusilla* (Lep.).—For the second year heavy infestations persisted on gray birch in Glengarry, Stormont, Dundas, and Grenville counties in the Rideau District. Pockets of white birch were heavily infested in Falconer Township, North Bay District, and in Chisholm and Lount townships, Parry Sound District. A medium infestation was observed on a small group of white birch trees in Buchanan Township, Pembroke District.

Lake Erie	1	Parry Sound	10
Lake Simcoe	2	Pembroke	5
Lindsay	16	Rideau	5
North Bay	3	Tweed	5

Basswood Leaf Miner, *Baliosus ruber* (Web.).—Basswood trees in a 200-acre stand of mixed hardwoods in Harvey Township, Lindsay District were severely attacked by the larvae of this beetle in 1956.

Lake Erie	1	Lindsay	4

European Elm Leaf Beetle, *Galerucella xanthomelaena* (Schr.).—A spread in the distribution of this introduced leaf beetle has been noted in southern Ontario during the past two years. In 1955, collections were submitted for the first time from the town of Essex, Lake Erie District, and in 1956 two new distribution records were established when it was collected from elm trees in the town of Amherstburg, Lake Erie District, and in Cobourg, Lindsay District. Although infestations which have occurred on the Niagara Peninsula for a number of years declined in intensity compared with 1955, the insect spread westward approximately 8 miles. Infestations previously reported in the towns of St. Thomas, and Tecumseh recurred in 1956.

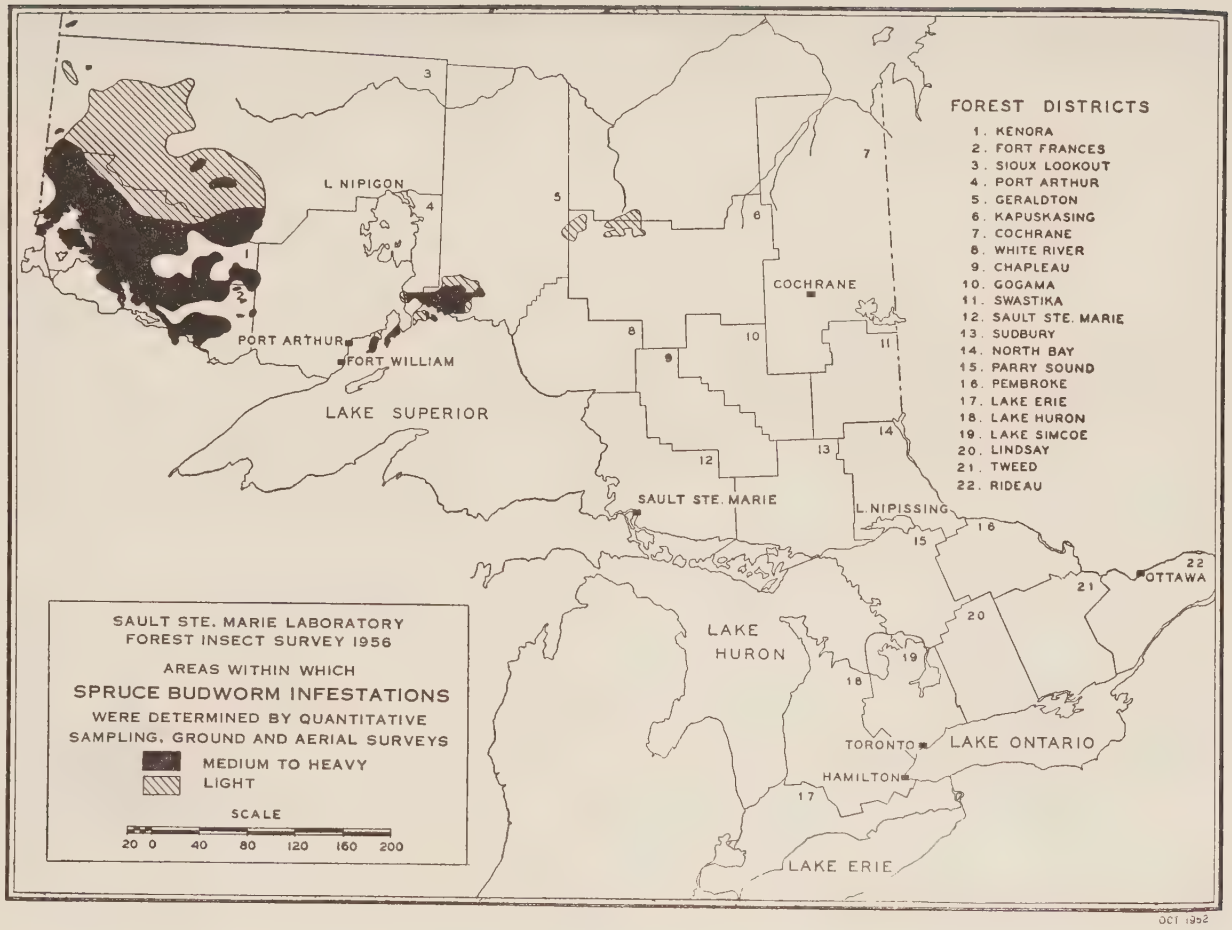
Lake Erie	18	Lindsay	1

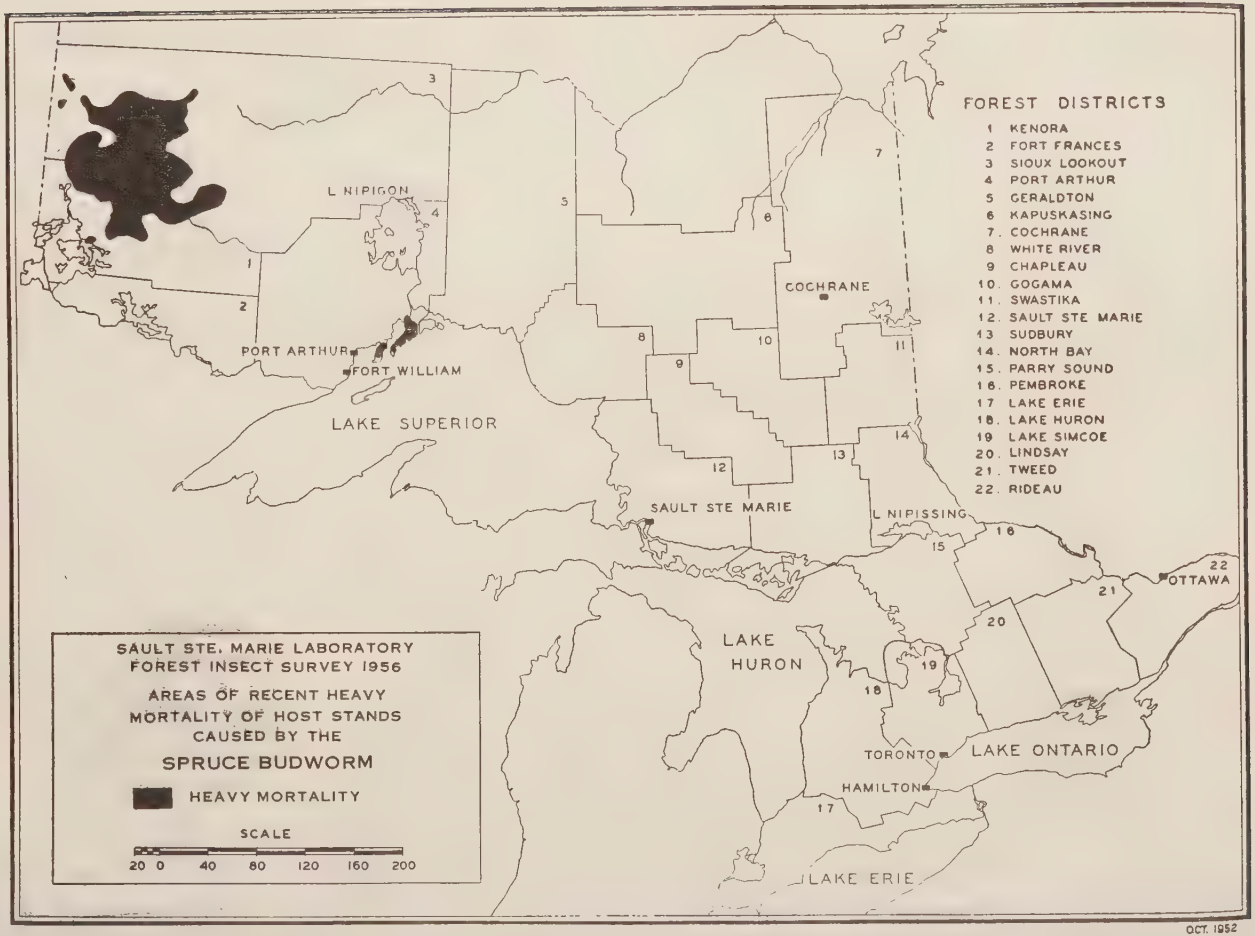
Birch Skeletonizer, *Bucculatrix canadensisella* Chamb.—Severe leaf skeletonizing was discovered for the first time in recent years in extensive white birch stands in the Kenora and Sioux Lookout districts and in woodlots throughout Charlotteville and South Walsingham townships in the Lake Erie District. No infestations were reported in northeastern Ontario where populations reached a high level in 1954 and declined in 1955.

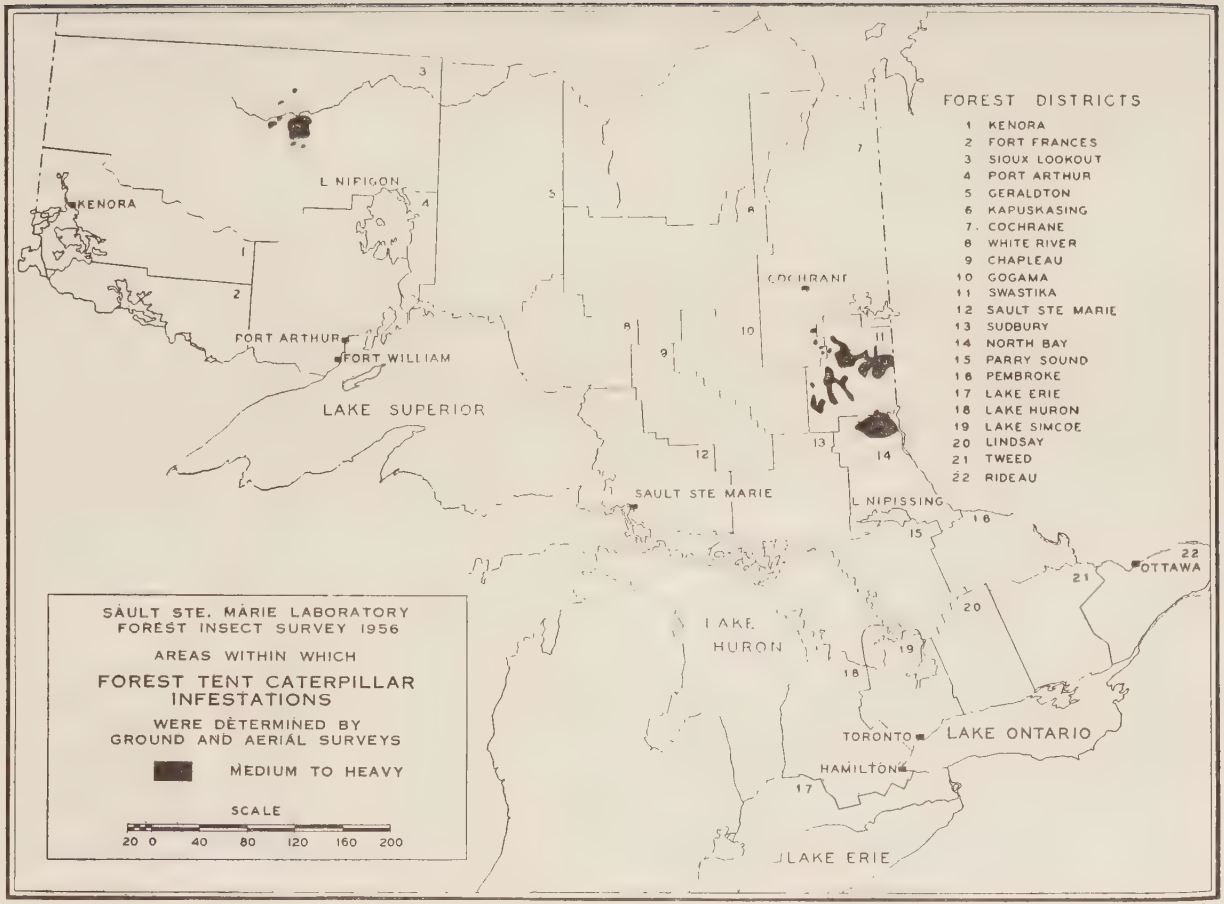
Kenora	1	Sioux Lookout	3
Lake Erie	3		

American Poplar Leaf Beetle, *Gonioctena americana* (Schaeff.).—Immature trembling aspen trees at widely separated locations were infested by this beetle. The heavy infestations reported in the Gogama District in 1955 declined to light intensity in 1956. Severe defoliation of small poplar trees was reported at numerous points in the Chapleau District.

Chapleau	29	Lindsay	3
Cochrane	15	Parry Sound	5
Fort Frances	3	Port Arthur	9
Geraldton	5	Sault Ste. Marie	3
Gogama	7	Sioux Lookout	1
Kapuskasing	7	Sudbury	5
Kenora	4	Swastika	13
Lake Simcoe	2	White River	10


FOREST DISTRICTS
1. KENORA
2. FORT FRANCES
3. SIOUX LOOKOUT
4. PORT ARTHUR
5. GERALDTON
6. KAPUSKASING
7. COCHRANE
8. WHITE RIVER
9. CHAPLEAU
10. GOGAMA
11. SWASTIKA
12. SAULT STE. MARIE
13. SUDBURY
14. NORTH BAY
15. PARRY SOUND
16. PEMBROKE
17. LAKE ERIE
18. LAKE HURON
19. LAKE SIMCOE
20. LINDSAY
21. TWEED
22. RIDEAU
L NIPIGON
PORT ARTHUR
FORT WILLIAM
LAKE SUPERIOR
COCHRANE
SAULT STE. MARIE
L NIPISSING
OTTAWA
LAKE HURON
TORONTO
LAKE ONTARIO
HAMILTON
LAKE ERIE
SAULT STE. MARIE LABORATORY
FOREST INSECT SURVEY 1956
AREAS WITHIN WHICH
SPRUCE BUDWORM INFESTATIONS
WERE DETERMINED BY QUANTITATIVE
SAMPLING, GROUND AND AERIAL SURVEYS
MEDIUM TO HEAVY
LIGHT
SCALE
20 0 40 80 120 160 200
OCT 1952


FOREST DISTRICTS
1 KENORA
2 FORT FRANCES
3 SIOUX LOOKOUT
4 PORT ARTHUR
5 GERALDTON
6 KAPUSKASING
7 COCHRANE
8 WHITE RIVER
9 CHAPLEAU
10 GOGAMA
11 SWASTIKA
12 SAULT STE MARIE
13 SUDBURY
14 NORTH BAY
15 PARRY SOUND
16 PEMBROKE
17 LAKE ERIE
18 LAKE HURON
19 LAKE SIMCOE
20 LINDSAY
21 TWEED
22 RIDEAU
L NIPIGON
PORT ARTHUR
FORT WILLIAM
LAKE SUPERIOR
COCHRANE
SAULT STE MARIE
L NIPISSING
OTTAWA
LAKE HURON
TORONTO
HAMILTON
LAKE ONTARIO
LAKE ERIE
SAULT STE. MARIE LABORATORY
FOREST INSECT SURVEY 1956
AREAS OF RECENT HEAVY MORTALITY OF HOST STANDS CAUSED BY THE
SPRUCE BUDWORM
HEAVY MORTALITY
SCALE
20 0 40 80 120 160 200
OCT. 1952


FOREST DISTRICTS
1 KENORA
2 FORT FRANCES
3 SIOUX LOOKOUT
4 PORT ARTHUR
5 GERALDTON
6 KAPUSKASING
7. COCHRANE
8 WHITE RIVER
9 CHAPLEAU
10 GOGAMA
11 SWASTIKA
12 SAULT STE MARIE
13 SUDBURY
14 NORTH BAY
15 PARRY SOUND
16 PEMBROKE
17 LAKE ERIE
18 LAKE HURON
19 LAKE SIMCOE
20 LINDSAY
21 TWEED
22 RIDEAU
L NIPIGON
KENORA
PORT ARTHUR
FORT WILLIAM
LAKE SUPERIOR
COCHRANE
SAULT STE MARIE
L NIPISSING
OTTAWA
LAKE HURON
TORONTO
LAKE ONTARIO
HAMILTON
LAKE ERIE
SAULT STE. MARIE LABORATORY
FOREST INSECT SURVEY 1956
AREAS WITHIN WHICH
FOREST TENT CATERPILLAR INFESTATIONS
WERE DETERMINED BY GROUND AND AERIAL SURVEYS
MEDIUM TO HEAVY
SCALE
20 0 40 80 120 160 200
OCT 1952

PROVINCE OF ONTARIO

FOREST DISEASE SURVEY

JAMES REID

Forest Pathology Laboratory, Maple, Ont.

INTRODUCTION

The resignation of key personnel during the winter of 1955-56 resulted in a marked reduction in Forest Disease Survey activities in Ontario in 1956.

A total of 325 samples was submitted by Forest Biology Rangers and other co-operators. Of these, 87 were classified as miscellaneous, a large proportion being samples tested for the presence of *Ceratostomella ulmi* (Schwarz) Buisman, the causal organism of Dutch elm disease. Within this latter group 25 samples were sterile in culture, while many others which were collected from dead trees produced numerous secondary organisms.

The collections were distributed among the host trees as follows:

Coniferous trees	Collections	Broad-leaved trees	Collections
Pine	53	Elm	148
Spruce	23	Poplar	13
Cedar	12	Birch	12
Balsam fir	7	Maple	7
Larch	3	Oak	5
		Willow	4
Total	98	Ash	3
		Horse-chestnut	2
		Alder	2
		Beech	1
		Mountain ash	1
		Total	198
		Miscellaneous hosts	29
		Grand Total	325

IMPORTANT DISEASES

Dutch Elm Disease.—The Maple Laboratory undertook in 1956 the culturing and identification of samples suspected of Dutch elm disease. Methods and procedures were modelled on those established by Dr. Ruth Macrae, Botany and Plant Pathology Division, Ottawa.

The accompanying map sets forth the total number of samples from which the causal organism was isolated for each county since the presence of the disease was first recorded in Ontario in 1946. In 1956 the organism was found in Halton, Victoria, Durham, and Lincoln counties for the first time. Marked increases in the numbers of confirmed disease samples were recorded for York and Welland counties.

There has been a decline in the number of submissions of suspect material from Essex County, which has long been a center of high disease incidence, and from the eastern counties where the disease was first found in Ontario.

It should be noted that, in the absence of a systematic survey similar to that undertaken when the disease was first reported in Ontario, the records presented on the accompanying map must be accepted as a minimum representation of the intensity of disease.

Shoestring Root Rot.—During 1956 collections of *Armillaria mellea* (Vahl ex Fries) Quél., were chiefly from pine species. Collections were made from several locations, notably from white and red pine plantations near Barrie, Ontario.

Fungi Causing Heart Rots of Living Trees.—During 1956 various fungi were recorded which cause heart rots of living trees. From trembling aspen *Fomes igniarius* (L. ex Fr.) Gill., *Radulum casearium* (Morg.) Lloyd, and *Pholiota spectabilis* Fries were located. *F. igniarius* was also isolated from white birch. From balsam fir *Stereum sanguinolentum* Alb. & Schw. ex Fries, *Odontia bicolor* (Alb. & Schw. ex Fr.) Bres., and *Corticium galactinum* (Fries) Burt. were isolated. From jack pine *Fomes pini* (Thore) Lloyd and *Polyporus tomentosus* Fries were isolated, while from various spruces cultures were obtained of *C. galactinum* and *F. pini*. Yellow birch and hard maple have also been sampled, but the results of these studies have not been compiled.

A Deterioration of Birch.—A deterioration of white and yellow birch, characterized by dieback of branch tips and occasionally crowns, continued to be found in Ontario. Results from the 1956 field season are incomplete at this time, and it is impossible to say whether or not the slight decline in the condition of yellow birch recorded throughout the period from 1953 to 1955 still persists.

Spruce Canker.—Collections from several areas in Ontario have confirmed the presence of spruce canker caused by *Cytospora kunzei* Sacc., on blue, white, black, and Norway spruce.

Canker and Dieback of Balsam Fir.—In the 1954 and 1955 editions of this report reference was made to a canker and dieback of balsam fir in Ontario. Further records of this condition were obtained during 1956. The positive identification of the fungi found on dying balsam fir, and the establishment of the relationship of these fungi with the disease condition, has been delayed through the curtailment of the Survey program.

White Pine Needle Blight.—Reports received from research officers studying white pine needle blight, indicate that the incidence of this condition was somewhat higher during 1956 than in 1955 especially in the Petawawa Forest Experiment Station area.

Leaf and Twig Blight of Poplar.—While no new centers of infection have been recorded for this disease it is still present in the previously recorded areas.

Butt Rot of Spruce.—*Polyporus tomentosus*, often listed as a cause of butt rot in white spruce, was collected on 26 occasions. Only one of the collections was found on a living white spruce tree but 16 were found growing on the ground in close proximity to white spruce trees. Five were found on black spruce trees, and one on a larch tree.

Damping-off of Nursery Seedlings.—Damping-off was a continuing problem in the Orono and Midhurst nursery beds; no organisms other than those which have previously been reported were isolated from seedlings.

OTHER NOTEWORTHY DISEASES

Host	Causal Agent	Location	Remarks
Horse-chestnut..	*Guignardia aesculi* (Pk.) Stew.	Toronto, York Co., L. Simcoe Dist., Peterborough, Peterborough Co., Lindsay Dist.	Leaf blotch of horse-chestnut. Quite prevalent in the Toronto area.
Maple and elm.....	*Verticillium* sp.	London, Middlesex Co., L. Erie Dist., Ottawa, Carleton Co., Rideau Dist., Ridgeway, Welland Co., L. Erie Dist.....	Vascular wilt.
Pine, jack and red..	*Coleosporium solidaginis* (Schw.) Thüm.	Agincourt, York Co., L. Simcoe Dist., Caledon Twp., Peel Co., L. Simcoe Dist., Sherwood Twp., Renfrew Co., Pembroke Dist., Amabel Twp., Bruce Co., L. Huron Dist.....	A pine needle rust.
Pine, jack..	*Cronartium comptoniae* Arth.	Ulster Twp., Sudbury Dist., Farquier Twp., Kapuskasing Dist....	A stem rust of pine.
Poplar.....	*Cytospora chrysosperma* (Pers.) Fr.	Islington, York Co., L. Simcoe Dist.....	Canker of poplar and willow.
Spruce.....	*Chrysomyxa ledi* (A. & S.) de Bary	Sioux Narrows, McGeorge Twp., Kenora Dist.....	A spruce needle rust.


PRESCOTT
1-
7-
OTTAWA
GLENGARRY
CARLETON
RUSSELL
2-
38-2
STORMONT
1
3
DUNDAS
PARRY SOUND
LENNOX
1-
GRENVILLE
&
FRONTENAC
LEEDS
2
LAKE HURON
ADDINGTON
1
OWEN SOUND
1
VICTORIA
KINGSTON
1
PRINCE
EDWARD
DURHAM
YORK
PEEL
1 13
4 2
TORONTO
LAKE ONTARIO
HALTON
1
13-2
HAMILTON
WENTWORTH
1
OXFORD
LINCOLN
MIDDLESEX
1-
2-
5-33
SARNIA
LONDON
1-2
HALDIMAND
WELLAND
LAMBTON
4-4
NORFOLK
5-3
6 2
ELGIN
38-1
WINDSOR
KENT
ESSEX
353-4
LAKE ERIE
MAPLE LABORATORY
FOREST DISEASE SURVEY 1956
KNOWN DISTRIBUTION BY COUNTY OF
DUTCH ELM DISEASE
IN ONTARIO
INFECTED TREES
353 - 4
1946-1955 - 1956
SCALE
20 10 0 20 40 60 80 100

PROVINCES OF MANITOBA AND SASKATCHEWAN

FOREST INSECT SURVEY

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INTRODUCTION

The major forest insects in Manitoba and Saskatchewan in 1956 were the spruce budworm, the larch sawfly, the jack-pine budworm, and the fall canker-worm. There was a general increase in the extent and intensity of spruce budworm infestations in Manitoba. The larch sawfly was again found in all tamarack stands examined, and a slight increase in populations was evident in southeastern Manitoba. Jack pine was severely attacked by the jack-pine budworm throughout a large portion of the Sandilands Forest Reserve. High population levels were also present in the Spruce Woods Forest Reserve, and posed a serious threat to pine plantations in this area. Localized infestations of the fall canker-worm caused severe defoliation of deciduous trees in some parks and shelterbelts in the prairie region.

Due to the increasing importance of the spruce budworm problem, especially in inaccessible areas, more time was devoted to aerial surveys than in previous years. Approximately 45 hours of flying were required to survey infestations in northern and eastern Manitoba.

Improved population sampling techniques were used for the spruce budworm and larch sawfly. The results allow more reliable estimates of the status of these species. A study of insects attacking the heavily-coned tops of black spruce was started, and despite rearing difficulties, some progress was made in determining the feeding habits of several species involved.

Detection surveys for the European pine shoot moth and the larch case bearer were carried out in southeastern Manitoba, but no specimens were found.

Samples received at the laboratory in 1956 totalled 3,338. Of these, 3,164 were submitted by Forest Biology personnel and 174 by provincial personnel and other co-operators. In addition to reporting on insect conditions, the Provincial forest services assisted by providing many valuable services essential to the operation of the Survey.

The number of collections from the principal host trees was as follows:

Coniferous trees	Collections	Broad-leaved trees	Collections
White spruce	655	Trembling aspen	563
Black spruce	457	Willow	221
Jack pine	406	Manitoba maple	141
Tamarack	260	White birch	102
Balsam fir	99	Choke cherry	94
Lodgepole pine	18	Balsam poplar	73
Scots pine	16	Alder	44
Other coniferous trees	8	Green ash	29
		White elm	24
Total	1919	Bur oak	17
		Caragana	6
		Other broad-leaved trees	23
		Total	1337
		Miscellaneous hosts	82
		Grand Total	3,338

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—Recent extensions of infestations of the spruce budworm in Manitoba necessitated intensified surveys in 1956. Included were aerial mapping of infested stands, ground surveys of defoliation and larval abundance, and egg counts for predicting infestation trends for 1957. Aerial surveys were made systematically over areas in Manitoba known to be infested with the budworm following predetermined flight lines at 6- to 8-mile intervals. Aerial observations were checked frequently with ground observations on the loss of current and old foliage. Outside of the main infestations, aerial surveys were restricted to major watersheds.

The following classification of infestations was used:

Severe — Balsam fir and white spruce distinctly red from the air; current growth of balsam fir and white spruce 70 to 100 per cent defoliated.

Moderate — Balsam fir and white spruce slightly red from the air; current growth of balsam fir and white spruce 30 to 60 per cent defoliated.

Light — No apparent discoloration of foliage from the air; current growth less than 30 per cent defoliated.

Egg surveys were carried out in eastern Manitoba as an aid in forecasting infestation trends in 1957. Since no satisfactory method has been developed for egg sampling on white spruce, these surveys were restricted to areas supporting balsam fir. The sequential system of sampling developed by Morris* was adopted.

As shown on the accompanying map, infestations were confined mainly to Manitoba. In the Eastern District the main infestation extended from the Manitoba-Ontario border in a northwesterly band covering the Manigotagan and Wanipigow watersheds, several large islands in Lake Winnipeg, and the Saint Lake area of the Interlake region. This infestation appears to be an extension of the large outbreak in the Sioux Lookout District of Ontario.

A somewhat smaller infestation developed along the Winnipeg River through the north end of the Whiteshell Forest Reserve. Shelterbelts of white spruce and natural stands of white spruce and balsam fir in the agricultural and resort areas of the Interlake region showed varying degrees of stripping of current foliage by the budworm. This situation combined with "winter drying" of old needles caused severe defoliation. Within the infestation described above, the total area of moderate to severe defoliation was approximately 500 square miles.

High budworm populations were found in the Spruce Woods Forest Reserve in the Southern District, but because of abundant foliage production, defoliation was generally classified as moderate. A similar condition was reported from a number of shelterbelts in southern Manitoba and Saskatchewan.

The infestation at Namew Lake on the Manitoba-Saskatchewan boundary continued at about the same intensity as in 1955. Light defoliation extended as far north as Maraché and Saskoba lakes.

Budworm damage was restricted to areas supporting a high percentage of balsam fir that had been severely infested for the past three years. Mortality was confined to young or over-topped balsam fir stands, but some larger trees are showing dead branches and tops. An increase in mortality can be expected if the infestation continues in 1957.

*Morris, R. F. A sequential sampling technique for spruce budworm egg surveys. Can. Jour. Zoology. 32:302-313. 1954.

A forecast of the probable infestation intensity at a number of representative points in eastern Manitoba in 1957 is shown in the following table.

Location	Defoliation 1956	Calculated No. of egg clusters/100 sq. ft. of foliage	Infestation rating forecast for 1957
Eaglenest Lake	moderate	415	severe
Garner Lake	severe	552	severe
Bushy Lake	moderate	453	severe
Manigotagan Lake	severe	820	severe
Wanipigow Lake	severe	834	severe
Pine Dock	severe	869	severe
Black Island	severe	563	severe
Dorothy Lake	nil	0	nil
Winnipeg River	severe	801	severe
Falcon Lake	light	26	light
Sandilands F.R.	moderate	151	moderate
East Braintree	light	26	light

Indications are that the infestations in eastern Manitoba will be confined to the same areas in 1957, at about the same intensity. Areas most susceptible to an extension of the infestations lie through the watersheds east of Lake Winnipeg, north of the Wanipigow River.

The following table shows the occurrence of spruce budworm larvae in collections from spruce and balsam fir during period of larval activity.

District	Collections from spruce and balsam fir	Percentage containing spruce budworm
Manitoba		
Southern	87	35.6
Eastern	103	51.4
Northern	73	24.6
Western	112	20.5
Saskatchewan		
Hudson Bay	100	8.0
Prince Albert	352	0.6
Meadow Lake	216	0.0
Northern	100	2.0
Southern	60	16.7
West-central	42	9.5

	Collections
Manitoba	125
Saskatchewan	26

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—The accompanying map shows the distribution and infestation ratings of the larch sawfly in tamarack stands in 1956. Ratings in permanent tamarack plots were based on egg population sampling, using as an index the percentage of current shoots utilized for oviposition. Limits for the three infestation classes of light, moderate, and severe were estimated from past survey egg counts in relation to subsequent defoliation. The infestation classes are shown in the following synopsis.

Infestation class	Percentage of current shoots utilized for oviposition
light	8 or less
moderate	10 - 22
severe	28 or more

Ratings in inaccessible areas were based on ocular defoliation estimates. Egg sampling has been carried out in 42 permanent plots for the past two years. The data summarized in the following table show population trends in plots of the various forest districts in 1956.

Forest District	Number of sample plots	Average percentage of current shoots utilized for oviposition	
		1955	1956
Manitoba			
Southern	4	6.6	8.8
Eastern	8	3.5	9.2
Western	8	1.4	1.3
Northern	4	5.4	2.3
Saskatchewan			
Hudson Bay	4	1.2	.9
Prince Albert	6	5.0	6.1
Northern	4	11.2	1.9
Meadow Lake	4	3.5	1.0

In Manitoba, slight increases were evident in some stands in the Whiteshell and Sandilands forest reserves. In Saskatchewan, high population levels were confined to the Doré-Smoothstone lakes area in the Prince Albert District and the Frobisher Lake area of the Northern District.

The most noticeable decline in sawfly numbers in recent years has been in the Hudson Bay District of Saskatchewan, and the Western and Northern districts of Manitoba. Defoliation was negligible in most tamarack stands in these districts in 1956 and it was often difficult to find sawfly larvae.

Jack-pine Budworm, *Choristoneura pinus* Free.—A general increase in population levels of the jack-pine budworm occurred throughout southeastern Manitoba. New infestations developed in pine plantations in the Spruce Woods Forest Reserve. The old infestations in the Stead-Belair and Rosenberg areas subsided.

Approximately 14,000 acres of jack pine around the periphery of the 1955 burn in the northern portion of Sandilands Forest Reserve were severely defoliated. A somewhat smaller infestation, covering 7,000 acres, developed in the southwest corner of the Reserve near Menisino. In both infestations all the current foliage was destroyed, and "back feeding" was common where populations were high.

About 500 acres of open-grown jack pine trees south of Hadashville in the Eastern District were also severely infested. These trees will be clear-cut during the winter of 1956-57 in an attempt to reduce the danger of the infestation extending to adjacent merchantable stands of higher value.

A general increase in the incidence of jack-pine budworm in pine plantations of the Spruce Woods Forest Reserve has been noted for the past two years. In 1956, moderate to severe infestations developed in a number of jack pine, lodgepole pine, and Scots pine plantings. This is the first record of this species reaching outbreak proportions in plantations in Manitoba. Scots and lodgepole pine plantings from 22 to 40 years of age were most severely attacked. In some lodgepole pine plots "winter drying" had killed all old foliage. These trees put forth new foliage in 1956 which was heavily attacked by the budworm. Some of the infested plantations are adjacent to native spruce trees, which were attacked by mixed populations of jack-pine budworm and spruce budworm.

In Saskatchewan, the jack-pine budworm was common throughout the Home, Red Rock, McDowall, and Steep Creek blocks of the Prince Albert District, but population levels were generally lighter than in 1955.

The following table shows the occurrence of jack-pine budworm larvae in collections from jack pine during the period of larval feeding.

District	Collections from jack pine	Percentage of collections containing jack-pine budworm
Manitoba		
Southern	79	63.3
Eastern	110	52.7
Northern	20	5.0
Western	25	24.0
Saskatchewan		
Hudson Bay	24	20.8
Prince Albert	77	23.4
Meadow Lake	3	0.0
Northern	55	3.6
Southern	4	75.0
West-central	9	0.0

	Collections
Manitoba	115
Saskatchewan	28

Fall Cankerworm, *Alsophila pometaria*(Harr.).—The fall cankerworm was the principal defoliator of deciduous trees in farm shelterbelts and parklands in 1956. In Manitoba, American elm was the species most severely attacked, but in Saskatchewan, the principal host was Manitoba maple.

A very severe infestation developed in the Portage la Prairie area of Manitoba. By June, elm, Manitoba maple, oak, basswood, and deciduous shrubs were completely stripped of foliage. Larval sampling indicated that 100 per cent of the leaf clusters on Manitoba maple were infested with cankerworm. Infested leaf clusters supported from three to eight larvae per cluster. Subsequent defoliation checks showed that sample trees with three or more larvae per leaf cluster were completely stripped. Smaller infestations also occurred in shelterbelts at Beauséjour, Ladywood, Elie, McDonald, and Brandon, and through the Interlake area in Manitoba.

The heaviest concentrations in Saskatchewan were in the Melville, Moose Jaw, Swift Current, and Maple Creek areas. Moderate defoliation of Manitoba maple and elm was reported from farm districts near Fir Mountain, Mankota, and Gravelbourg.

	Collections
Manitoba	
Southern	15
Eastern	3
Saskatchewan	
Southern	29
West-central	8

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.).—This sawfly continued to be a major pest of shelterbelt and ornamental spruce trees in the prairie and aspen grove regions of the two provinces. It was also common in some natural stands of white spruce.

The most severe infestations were in unsprayed shelterbelts near Meadow Lake and Makwa River in the Meadow Lake District. Infestations reported in 1955 from the Hudson Bay District, subsided in 1956 although no spraying had

been carried out. Elsewhere in the two provinces the status of the yellow-headed spruce sawfly remained unchanged.

	Collections
Manitoba	
Southern	6
Eastern	2
Northern	5
Western	12
Saskatchewan	
Hudson Bay	18
Prince Albert	6
Meadow Lake	12
Northern	4
Southern	14
West-central	14

Pine Root-collar Weevil, *Hylobius radicis* Buch.—The known distribution of the pine root-collar weevil was unchanged, but the insect continued to be a serious plantation problem in the Sandilands Forest Reserve. For the past two years mortality surveys have been carried out in 8- to 19-year old plantations of Scots, lodgepole, and red pine. The average percentage of tree mortality in these plantations is shown by years in the following summary:

No. of plantations	Area in acres	Species of Pine	Percentage mortality	
			1955	1956
6	105.5	Scots	12	17
2	13.1	lodgepole	16	26
1	6.7	red	0	0
2	14.7*	lodgepole	8	12
		Scots	22	29
1	22.1	Scots	10	15
		red	0	0
1	10.7	lodgepole	6	8
		Scots	5	10
		red	0	0

In individual plantations, mortality of Scots and lodgepole pine was as high as 40 per cent. Some girdling of red pine roots was observed but no trees were killed.

Similar surveys were carried out in 460 acres of Scots and lodgepole pine plantations in the Spruce Woods Forest Reserve, but no evidence of weevil attack could be detected on living or dead trees in this area. These plantings are 200 miles west of the Sandilands infestation.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.).—An infestation of the large aspen tortrix developed in the agricultural area of the Interlake region in 1956. Trembling aspen in shelterbelts and woodlots in the vicinity of Dog Lake, Ashern, and Poplarfield were severely defoliated. Light populations were present in the Western District of Manitoba and the Hudson Bay District of Saskatchewan. In the latter, local infestations developed in the Carrot River, Reserve, and Kelvington areas.

In the agricultural area of Saskatchewan local infestations were reported from Moose Mountain, Regina, Raymore, and Melville. Heavy concentrations of moths were noticed in all the above areas in July. The Meadow Lake District has been free of outbreaks of the aspen tortrix for the past two years. However, a build-up of populations was again evident in the Loon Lake area in 1956.

*Tree species in mixed plantations listed in order of abundance.

The following table shows the occurence of aspen tortrix larvae in collections from trembling aspen during the period of larval activity:

District	Collections from trembling aspen	Percentage containing large aspen tortrix
Manitoba		
Southern	54	0.0
Eastern	57	24.6
Northern	43	2.3
Western	57	36.8
Saskatchewan		
Hudson Bay	105	32.4
Prince Albert	51	23.5
Meadow Lake	35	22.9
Northern	16	0.0
Southern	81	27.3
West-central	65	52.3

	Collections
Manitoba	36
Saskatchewan	112

Boxelder Twig Borer, *Proteoteras willingana* (Kft.).—This twig borer has increased noticeably on Manitoba maple in farm shelterbelts and parklands of southern Saskatchewan and Manitoba for the past two years. Characteristic damage is gall-like swellings and tunnelling in the current twigs. The injury frequently causes the twig to break off. Branch counts from Manitoba maple trees in the southern districts showed the following percentage of infested twigs.

Forest district	No. of sample points	Average percentage of twigs infested in 1956
Manitoba		
Southern	7	13.4
Saskatchewan		
Southern	9	24.3
West-central	5	9.7

Grey Willow-Leaf Beetle, *Galerucella decora* (Say).—Severe skeletonizing of willow foliage occurred across southern Manitoba and Saskatchewan, and the Hudson Bay, Prince Albert, and Northern forest districts. Throughout this entire area, willow growing along roadsides and on low-lying lands had a burned appearance by late July due to larval feeding. In early summer adult beetles were often found feeding on trembling aspen but defoliation was relatively light.

	Collections
Manitoba	
Southern	2
Eastern	3
Northern	22
Western	3
Saskatchewan	
Hudson Bay	35
Prince Albert	32
Northern	14
Southern	18
West-central	23

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—No infestations of the forest tent caterpillar were reported in Manitoba and Saskatchewan, but larvae and pupae were collected in five districts. In southern Saskatchewan

single larvae were collected in a number of 5-tree beating samples from aspen. A total of nine collections was made in the Cypress Hills area. Egg sampling in this region showed an average of one egg cluster per 3-tree sample.

	Collections
Manitoba	
Southern	1
Eastern	1
Northern	1
Saskatchewan	
Northern	2
Southern	14

Birch Skeletonizer, *Bucculatrix canadensisella* Chamb.—Browning of birch foliage was common in the Eastern District of Manitoba, particularly in the Interlake area.

	Collections
Manitoba	
Eastern	14
Western	1
Saskatchewan	
Southern	2

Aspen Blotch Miner, *Lithocolletis salicifoliella* Chamb.—Population levels of the aspen blotch miner remained very low for the second consecutive year.

	Collections
Manitoba	
Southern	2
Eastern	8
Northern	5
Western	3
Saskatchewan	
Hudson Bay	2
Prince Albert	2
Northern	1
Southern	1
West-central	3

Boxelder Leaf Roller, *Gracillaria* prob. *negundella* Chamb.—No outbreaks of this species were recorded, but it caused light defoliation of Manitoba maple in parts of southern Manitoba and Saskatchewan.

	Collections
Manitoba	
Southern	5
Eastern	5
Northern	1
Western	2
Saskatchewan	
Prince Albert	1
Southern	12
West-central	13

Pitch Nodule Maker, *Petrova albicapitana* (Busck).—Pitch nodules formed by this species were again common on regeneration and plantation jack pine. A severe infestation continued for the second consecutive year in a 40-acre plantation in the Nisbet Provincial Forest of Saskatchewan.

	Collections
Manitoba	
Southern	21
Eastern	15
Northern	2
Western	3
Saskatchewan	
Hudson Bay	14
Prince Albert	28
Northern	10

Pine Tortoise Scale, *Toumeyella numismaticum* (P. & M.).—A slight increase in populations of this scale was reported from the old infestation in the Sandilands Forest Reserve, and the Stead-Belair areas in the Eastern District. Very little evidence of new damage was found in the Nisbet Provincial Forest Reserve in Saskatchewan. In all the above areas, the two-spotted lady beetle, *Hyperaspis binotata* (Say), an important predator of the scale, has been very abundant for the past two years.

	Collections
Manitoba	
Southern	5
Eastern	19
Northern	1
Western	3
Saskatchewan	
Hudson Bay	5
Prince Albert	8

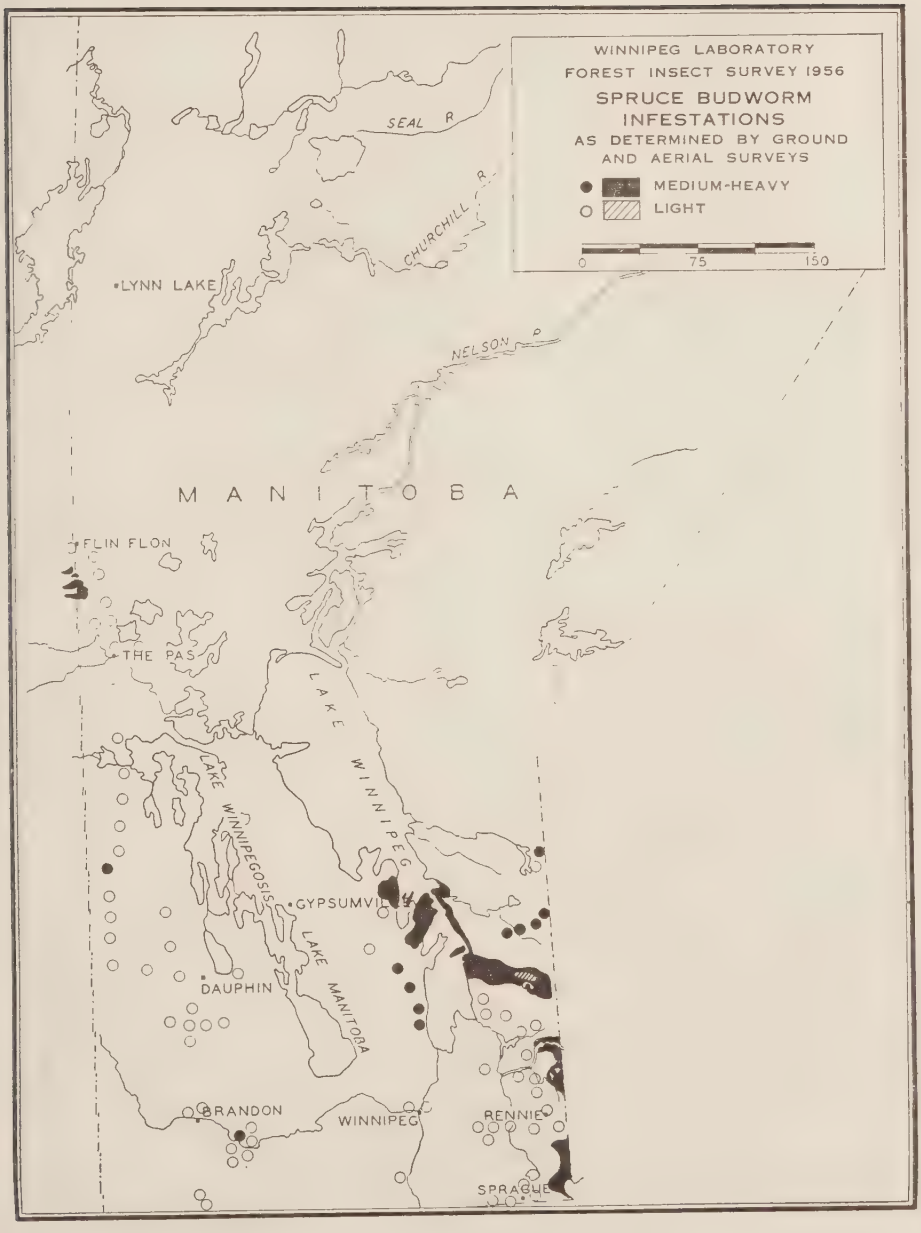
White-pine Weevil, *Pissodes strobi* Peck.—The most conspicuous killing of leaders from weevil attack occurred in natural stands of jack pine and plantations of Scots pine in the Sandilands Forest Reserve. This is the first record of weevil injury to Scots pine in this area.

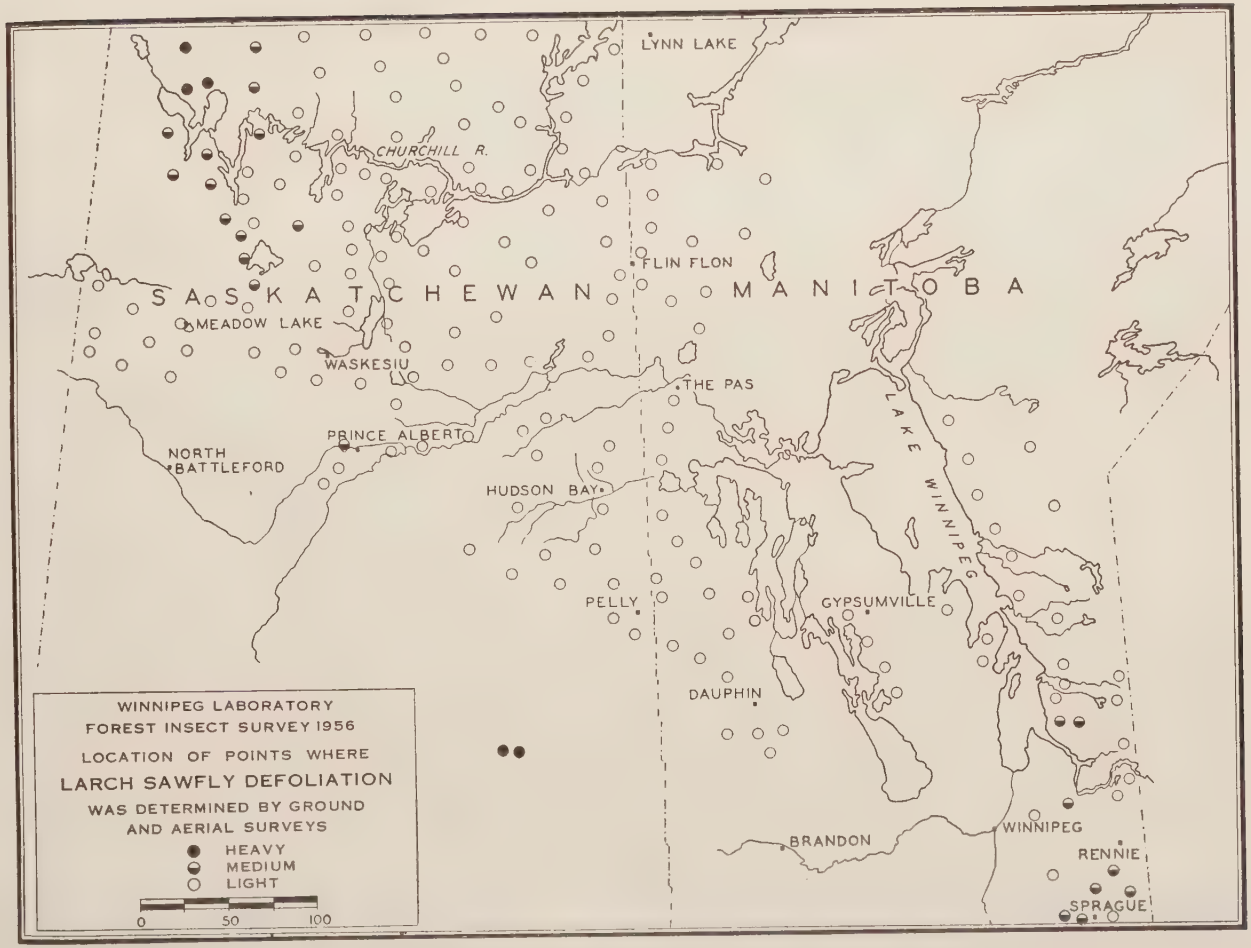
Pitch Midge, *Retinodiplosis* sp.—This species, tentatively identified as *Retinodiplosis resinicola* (Osten Sacken) has not been abundant in Manitoba or Saskatchewan during recent years. A moderate infestation, however, occurred on jack pine in the Stead area of Manitoba in 1956. Observations indicated that this was the second year of tip-killing of branches. The insect was common on trees ranging from 5 to 60 years of age over an area of 2 square miles. Representative counts on open-grown 26-year-old trees showed that 7 per cent of the shoots of jack pine supported one or more pitch masses containing midge larvae.

Insects Attacking Black Spruce.—In 1955 a complex of insects was reported feeding in "club-topped" black spruce in northern Manitoba and Saskatchewan. In 1956, a study was initiated to determine the species involved and the type of damage caused by each. The following table shows the relative abundance of six species in collections taken from black spruce tops.

District	Collections from black spruce	Percentage of samples containing larvae of various species					
		Dioryctria abietella	Herculia thymetusalis	Archips alberta	Epizeuxis aemula	Acleris variana	Gelechiid spp.
Manitoba							
Northern	30	16.7	33.3	0.0	10.0	43.3	23.3
Saskatchewan							
Prince Albert	179	10.1	30.2	18.9	4.0	10.6	16.2
Meadow Lake	106	0.0	4.8	.9	0.0	0.0	2.8
Northern	76	9.2	43.4	11.8	18.4	7.9	18.4

Critical examination of sample branches from three crown levels of infested trees showed that the complex was confined entirely to the upper crown of "club-topped" trees. Field observations and insectary rearings indicated that *Dioryctria abietella* (D. & S.) fed mainly on cones, and *Herculia thymetusalis* Wlk., *Archips alberta* McD., *Acleris variana* (Fern.), and *Epizeuxis aemula* Hbn. fed on foliage. The Gelechiid spp. were primarily needle miners. The damage to black spruce is cumulative. In some areas the "club-topped" trees had four years' accumulation of dead cones, mined needles, and frass.


WINNIPEG LABORATORY
FOREST INSECT SURVEY 1956
SPRUCE BUDWORM
INFESTATIONS
AS DETERMINED BY GROUND
AND AERIAL SURVEYS
MEDIUM-HEAVY
LIGHT
0
75
150
SEAL R.
CHURCHILL R.
LYNN LAKE
NELSON R.
MANITOBA
FLIN FLON
THE PAS
LAKE WINNIPEG
LAKE WINNIPEGOSIS
GYPSUMVILLE
DAUPHIN
LAKE MANITOBA
BRANDON
WINNIPEG
RENNIE
SPRAGUE


LYNN LAKE
CHURCHILL R.
FLIN FLON
SASKATCHEWAN
MANITOBA
MEADOW LAKE
WASKESIU
THE PAS
PRINCE ALBERT
NORTH BATTLEFORD
HUDSON BAY
LAKE WINNIPEG
PELLY
GYPSUMVILLE
DAUPHIN
BRANDON
WINNIPEG
RENNIE
SPRAGUE
WINNIPEG LABORATORY
FOREST INSECT SURVEY 1956
LOCATION OF POINTS WHERE
LARCH SAWFLY DEFOLIATION
WAS DETERMINED BY GROUND
AND AERIAL SURVEYS
HEAVY
MEDIUM
LIGHT
0
50
100

PROVINCES OF MANITOBA AND SASKATCHEWAN

FOREST DISEASE SURVEY

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INTRODUCTION

In previous years the Forest Disease Survey has indicated the general distribution and range of the more conspicuous forest diseases and slash fungi within the more accessible areas of the Region. The diminishing amount of new information being received, and the repetition of previous results required a more specialized type of survey. Accordingly, the objectives may now be classified as: i) to extend the present knowledge of the geographical range of diseases and associated organisms, and ii) to obtain detailed information on diseases of particular interest to current research projects. In this report only the more significant observations within these objectives are specifically mentioned. A large number of collections and reports pertaining to other disease conditions were submitted. Many of the collections have been added to the herbarium and will provide useful material for a future cumulative report. No diseases were reported in unusually severe concentration in 1956.

IMPORTANT DISEASES

Spruce Mistletoe.—For the third year the special search for previously unrecorded locations of *Arceuthobium pusillum* has failed to extend the known western or northern limits of the range of this mistletoe beyond those recorded in the 1953 report.

Jack Pine Mistletoe.—The most northerly record of occurrence is in the vicinity of Careen and Black Birch lakes, at approximately 57° north latitude. This, and other reports show that *Arceuthobium americanum* is widely distributed in the coniferous forests of northern Manitoba and Saskatchewan, though little is yet known about its incidence in that region. It is known to occur generally throughout the mixedwood forests farther south.

Wallrothiella on Jack Pine Mistletoe.—This parisitic fungus, which effectively prevents normal seed development in *Arceuthobium americanum*, has now been reported from the north end of Churchill Lake, north latitude 56° 10′, at the edge of the Precambrian Shield. South of the Shield it is known to be generally distributed wherever the mistletoe occurs.

Radulum casearium.—This poplar trunk rot fungus has been reported from many localities throughout the mixedwood forests of Manitoba and Saskatchewan.

PROVINCE OF ALBERTA

FOREST INSECT SURVEY

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INTRODUCTION

The larch sawfly was the most serious forest insect in Alberta in 1956. The yellow-headed spruce sawfly, the fall cankerworm and the spruce spider mite were present in large numbers in many shelterbelts and did serious damage where insecticides were not applied. The root weevil, *Hylobius* sp., caused widespread damage in 1956 that was augmented by a root rot and winter damage. The large outbreak of the spruce budworm along the Mackenzie River in the Northwest Territories persisted.

A survey was made by boat from Fort Nelson, B.C., down the Fort Nelson, Liard, and Mackenzie rivers to Aklavik, N.W.T.; on the return journey a survey was made up the Mackenzie, along the south shore of Great Slave Lake and up the Slave and Athabasca rivers to Fort McMurray, Alta.

The assistance of provincial and federal government agencies and forest industries in making collections and aiding forest biology rangers is gratefully acknowledged.

The 1,596 collections received in 1956 were taken from the following tree hosts.

Coniferous trees	Collections	Broad-leaved trees	Collections
Spruce	577	Trembling aspen	163
Pine	286	Willow	83
Larch	158	Manitoba maple	49
Douglas fir	53	Poplar	43
Fir	54	Alder	21
Juniper	8	Birch	20
		Ash	11
Total	1,136	Elm	4
		Total	394
		Miscellaneous hosts	66
		Grand Total	1,596

IMPORTANT INSECTS

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—Observations during a boat trip up the Slave and Athabasca rivers indicated that the larch sawfly was present from the mouth of the Peace River to Fort McMurray. Elsewhere in the Province little extension of the distribution mapped in 1955 was reported.

The heaviest defoliation occurred in a triangular area extending from Barrhead to Spedden and north to the mouth of the Peace River. The Forest Officer at Fort McMurray reported that the larch over the entire district presented a brown appearance from the air.

Light to moderate damage was reported over the remainder of the area infested in 1955. North and west of Red Deer, defoliation was not as severe as in 1955 and cocoons were only half as plentiful. Predation by rodents was much

lighter, however, and the number of adults emerging in 1957 is expected to equal or exceed that which emerged in 1956. Fewer larvae were found in the Spruce Grove-Edmonton area where rodent predation was heavy in the fall of 1956. As in 1955 damage north and west of Lesser Slave Lake was very light.

In Jasper National Park a small infestation has been present for 3 years in a small isolated stand of tamarack along the Miette Hot Springs Road.

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—The spruce budworm infestation along the Mackenzie River covered a large area but was patchy and could best be described as a series of outbreaks of varying intensity occupying areas of from a few acres to many square miles. It stretched along the Mackenzie River from a point 15 miles northwest of Fort Simpson to 40 miles northwest of Norman Wells, a distance of about 500 miles. The heaviest damage occurred a few miles north of Fort Norman, and around the mouths of the Redstone, Dahadinni, Blackwater, and North Nahanni rivers where the loss of the current year's foliage ran as high as 100 per cent. In localities where the outbreak could be dated back to 1953 the trees looked unhealthy and adventitious budding had produced noticeable brooming.

Occasional spruce budworm larvae were found at most stops along the Liard River from the British Columbia boundary to Fort Simpson. A small infestation extending for 10 miles along the Slave River, 100 miles north of Fort Smith, N.W.T., caused medium defoliation of a mature stand of spruce.

Damage by the 2-year-cycle spruce budworm was greater than in 1955 since 1956 was a flight year. Infestations were found at many places in the National Parks. In Yoho Park moderate to heavy damage was found at the south end of the Ice River Road, at Boulder Creek, and at the Kicking Horse Camp Grounds. Light damage extended 3 miles up the Yoho River Valley, along Kicking Horse River Valley from the mouth of the Yoho to Leanchoil, and along the Emerald Lake, Amiskwi and Ice River roads. In Kootenay Park light damage was found between Marble Canyon and Wardle Creek; between these points larvae were most numerous at Hawk Creek and Vermilion Crossing. In Banff Park moderate damage occurred between Mile 84 and 85 on the Banff-Jasper Highway.

Black-headed Budworm, *Acleris variana* (Fern.).—Damage caused by this insect continued to increase in 1956. In the Porcupine Hills a high percentage of the new buds was destroyed. Over the rest of the forested area south of the Bow River and in the Cypress Hills fairly large numbers of larvae were again present. In Banff National Park population levels increased in the Spray River Valley and for about 7 miles up the Cascade Fire Trail. Damage was moderate. Little or no damage was reported from other areas of the Province although larvae were frequently collected.

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* (Roh.).—The yellow-headed spruce sawfly caused serious defoliation of spruce in the Edmonton district. The heaviest damage was found within a radius of 50 miles of Edmonton where most of the shelterbelts were infested and defoliation ranged from medium to heavy. In the Wetaskiwin-Red Deer area damaged shelterbelts were less common than in 1955. Spraying in 1955 is believed to be responsible for the reduction. In the Peace River Block defoliation was less severe than in 1955.

The population levels on native spruce trees 1 mile southeast of the Gap Ranger Station in the Livingstone Forest Reserve were greatly reduced by a heavy hail storm. After the storm few larvae could be found on the trees but many dead larvae were on the ground. A stand of open-grown white and black spruce near Rossington, Alta., was 50 per cent defoliated and many larvae were still feeding at the time of observation. Light damage to fringe trees was reported from Fort Resolution and Fort Smith, N.W.T.

Neodiprion Sawflies, *Neodiprion* spp.—There was a slight increase in the numbers of these sawflies in 1956. This increase was particularly noticeable on Douglas fir and spruce in the forested area south of the Bow River.

Engelmann Spruce Beetle, *Dendroctonus engelmanni* Hopk.—A small infestation 17 miles south of the Castlemount Ranger Station in the Crowsnest Forest Reserve has destroyed at least 35 per cent of the volume of the stand. A few large-diameter trees are still being killed each year. Heavy blow-down in a residual stand following a 24-inch-diameter-limit cut has provided ideal conditions for further increases.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch).—The severe infestation of pine needle scale on lodgepole pine along the Adanac Mine Road reported last year almost disappeared in 1956. Predation by the twice-stabbed lady beetle, *Chilocorus stigma* (Say), was heavy but overpopulation was mainly responsible for the reduction in scale numbers. On many of the trees the scales were so thickly clustered that the needles were killed before the female scales completed development. A few trees have died and many have lost all but the current year's needles. Lightly infested trees were present around the periphery of the area. A small but severe infestation was reported along the York Creek Road 1 mile south of Coleman.

Spruce Spider Mite, *Paratetranychus ununguis* (Jac.).—Damage to shelterbelts in the central part of the agricultural area of Alberta increased in 1956. Warm dry weather during the spring caused a rapid build-up in early generations and damaged trees were very noticeable. In Banff and Jasper townsites this mite was responsible for considerable needle drop from many trees and hedges. Light infestations were reported from Radium Hot Springs and Kananaskis Forest Experiment Station. Light populations of an unknown mite on tamarack were found throughout the Clearwater Forest District.

A Root Weevil, *Hylobius* sp.—Although known to occur in Alberta, it was not until 1956 that this weevil was suspected of causing severe damage in pine stands. Unfavorable winter conditions and a root rot also caused damage. The combined effect of these factors caused concern to provincial foresters and forest industries.

Extensive ground surveys in the western half of the Province showed that the weevil was present in most lodgepole pine stands north of the Bow River. Heaviest infestations were reported from the Clearwater and Red Deer ranger stations, and from 5 miles south of Wilson Creek in the Clearwater Forest. Near Robb, 9 out of 10 mature trees examined were damaged and in an old burn a few young trees were completely girdled. Farther north in lodgepole pine stands south of the Wapiti River 90 per cent of the trees inspected were attacked. Girdling of small trees was quite common in the Two Lakes area south of Grande Prairie. This insect was also found in many of the jack pine stands in the Grande Prairie and Peace River forest divisions but no serious outbreaks were observed.

In the National Parks this weevil was reported from Healy Creek in Banff Park, near Leanchoil and Misko Siding in Yoho Park, and from 2 miles north of Kootenay Crossing to the southern end of the Settlers Road in Kootenay Park.

The accompanying map shows the distribution and hosts on which this insect occurred.

Lodgepole Needle Miner, *Recurvaria* sp.—Infestations of the lodgepole needle miner remained at a low level in 1956. Sequential sampling showed less than 1 larva per tip in most of the area formerly infested. The highest numbers per tip were reported from Leach Lake in Jasper Park, Hawk Creek in Kootenay Park, and from Mount Eisenhower and Mount Girouard in Banff

Park. Close to 5 insects per tip were found indicating that these infestations were in the "light" category of the needle miner sequential sampling classification.

Fall Cankerworm, *Alsophila pometaria* (Harr.).—Damage by the fall cankerworm in southern Alberta has been increasing during recent years. In 1956 heavy infestations were found immediately north and east of Lethbridge, between Suffield and Brooks, and in the Iddesleigh, Bow Island, and Milk River districts. Moderate infestations were found south of Lethbridge, and along Highway 3 between Lethbridge and Medicine Hat. Moderate infestations were also found at Patricia and Princess. Light infestations were present in most shelterbelts visited throughout the remainder of the Lethbridge and Medicine Hat agricultural districts.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—The area infested by the forest tent caterpillar at Mile 103 on the Mackenzie Highway remained unchanged in 1956. This small infestation has persisted since the general outbreak in 1953. In 1956 a severe spring frost killed most of the aspen foliage but a few sheltered or late opening buds provided enough foliage to keep the infestation from dying out entirely. Defoliation, however, was negligible.

A few reports of *M. disstria* feeding on shelterbelts and river-bank trees were received from the Lethbridge area.

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar).—A few tents were found in the northern part of the Province. The infestation reported last year along the Mackenzie Highway subsided and little damage was observed. Small lightly infested areas were reported along the Fort Fitzgerald-Fort Smith Portage and along the Athabasca River between Fort Resolution and Fort McMurray.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.). *Compsolechia niveopulvella* Cham., and *Epinotia* sp.—The outbreak of *C. conflictana* which caused heavy defoliation of aspen near Fort Vermilion in 1954 subsided and only patches of light defoliation occurred in 1956. The other small infestations which were reported from the northwestern part of the Province in 1955 have disappeared.

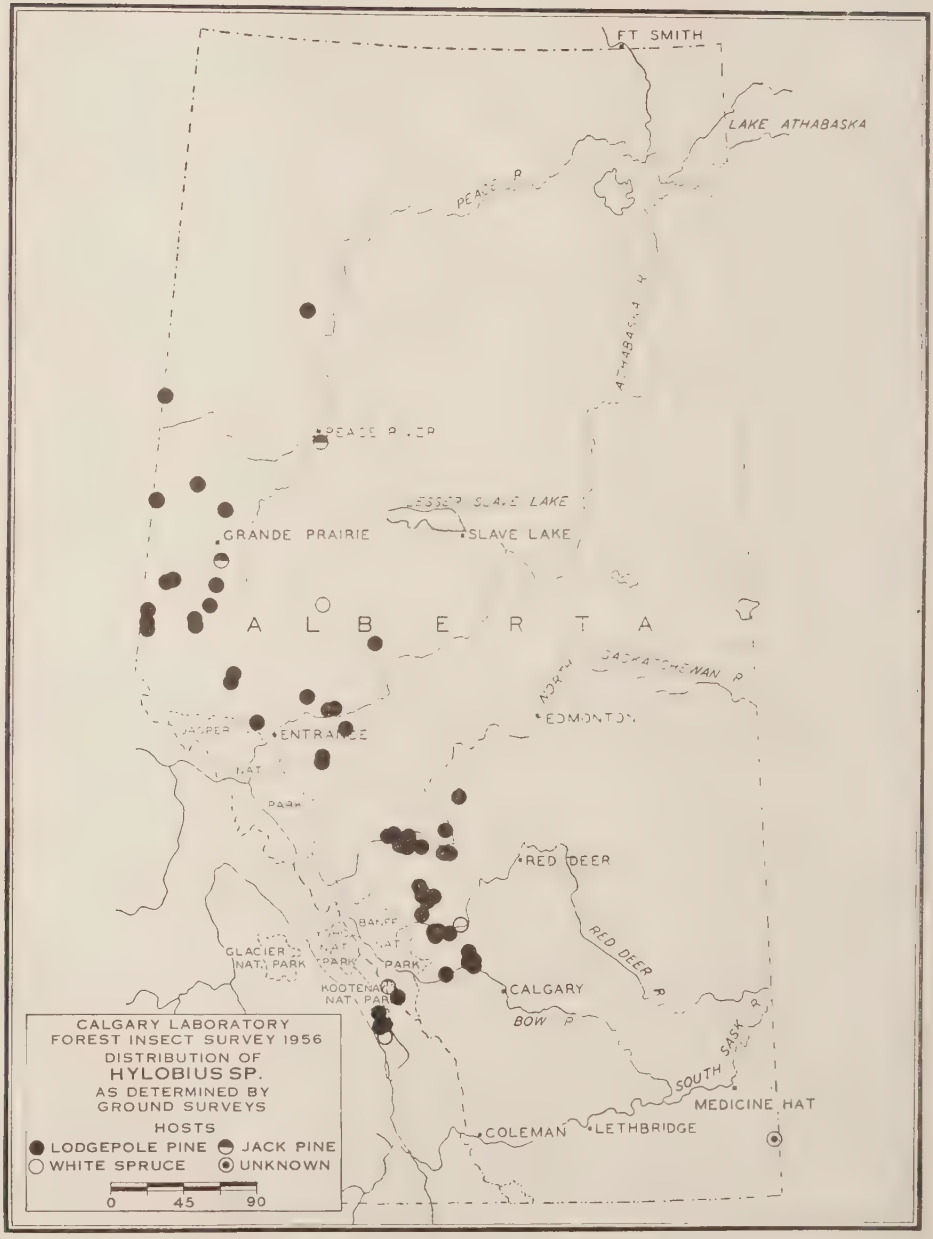
The three species listed above were responsible for defoliating aspen throughout west-central and southern Alberta in 1956. Heavy defoliation took place in the West Porcupine Hills, in a 500-square-mile area between Olds and Red Deer, and in the area between Wabamun Lake and the North Saskatchewan River. Small infestations were reported along the Peers-Whitecourt Road in central Alberta and from Baker and Carrot creeks in Banff National Park.

Bruce Spanworm, *Operophtera bruceata* (Hulst).—This insect was responsible for 90 per cent defoliation of aspen around Obed where it was associated with small numbers of the loopers, *Dysmigia loricaria* Evers. and *Campaea perlata* Gn. Light defoliation was caused by these three species from Hinton to Entwhistle.

In the fall of 1956 large moth flights of Bruce spanworm were reported from Edson and Bragg Creek.

Leaf Eating Beetles, *Gonioctena americana* (Schaeff.) and *Galerucella decora* (Say).—The American poplar beetle, *G. americana*, was present in small numbers in southwestern Alberta and at Sundre and Saunders west of Red Deer and Olds but no serious defoliation was observed.

A few collections of the gray willow-leaf beetle, *G. decora*, which has been unreported since 1953, were received from the Alberta Beach area. In the past this beetle has been cyclic in abundance and its presence in 1956 after 2 years' absence may indicate the beginning of an outbreak.


FT SMITH
LAKE ATHABASKA
PEACE R
ATHABASKA R
PEACE R.CR
ESSER SLAVE LAKE
GRANDE PRAIRIE
SLAVE LAKE
A L B E R T A
NORTH SASKATCHEWAN R
EDMONTON
JASPER
ENTRANCE
RED DEER
RED DEER R
BANFF
GLACIER NAT. PARK
KOOTENAY NAT. PARK
CALGARY
BOW R
SOUTH SASK R
MEDICINE HAT
COLEMAN
LETHBRIDGE
CALGARY LABORATORY
FOREST INSECT SURVEY 1956
DISTRIBUTION OF
HYLOBIUS SP.
AS DETERMINED BY
GROUND SURVEYS
HOSTS
LODGEPOLE PINE
JACK PINE
WHITE SPRUCE
UNKNOWN
0
45
90

PROVINCE OF ALBERTA

FOREST DISEASE SURVEY

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INTRODUCTION

During the 1956 field season, the emphasis in the Forest Disease Survey was placed on the detection of forest disease conditions that appeared to be causing serious losses. This has always been a major concern of the Survey but the establishment of a comprehensive disease herbarium for the district was also considered of great importance to assist in the priority assignment of research in the early years of operation of the Calgary Laboratory. The mass collection methods, useful in the initial stages of the Survey, were abandoned in 1956 in favor of selective sampling of those conditions that appeared to be causing economic loss. A special survey in the Mackenzie Valley did not reveal any serious disease conditions other than decays.

A total of 302 collections were processed in 1956; of these, 106 have been identified, 20 were discarded as unidentifiable, and 136 specimens of Thelephoraceae have been filed for future study. The assistance of the Mycology Unit, Botany & Plant Pathology Division, Ottawa, in identifying fungi is gratefully acknowledged. The Department of Lands & Forests of the Province of Alberta assisted in many valuable ways.

The collections were distributed among the various hosts as follows:

Coniferous trees	Collections	Broad-leaved trees	Collections
White spruce	106	Trembling aspen	12
Lodgepole pine	100	Balsam poplar	7
Black spruce	7	White birch	7
Douglas fir	6	Others	22
Alpine fir	3		48
Jack pine	2		
Others	30		
	254		
Grand Total	302		

IMPORTANT DISEASES

Atropellis Canker of Pine.—Heavily infected (over 70 per cent of the trees infected) advanced reproduction and pole-size stands were located near the Castlemount Ranger Station in the southern part of the Crowsnest Forest. Similar conditions were found near Nordegg in the Clearwater Forest and on the Kananaskis Forest Experiment Station. Moderately infected areas (between 40 and 70 per cent of the trees infected) were located in the Porcupine Hills in the Crowsnest Forest and at points near the Baseline Lookout and the Red Deer Ranger Station in the Clearwater Forest. This information, together with that obtained in previous years indicates that pine stands, moderately to heavily infected with *Atropellis piniphila* (Weir) Lohman & Cash, occur sporadically throughout the East Slope region of the Rocky Mountains in Alberta.

Hail Damage.—Reports of dead poplar stands in the parkland regions west of Edmonton near Derwent and Ruysylvia were investigated. A severe hail storm occurred in this area 6 or 7 years ago according to local residents. Many hail scars of a corresponding age were found on the trees. It was concluded that an exceptionally heavy hail storm about 1949 or 1950 was primarily responsible for the death of the trees. The area involved is approximately 4 miles by 25 miles.

Needle Cast of Lodgepole Pine.—This disease, caused by *Hypodermella montivaga* (Petrak) Dearn., was reported in outbreak proportions in parts of Banff and Jasper National Parks during 1954 and 1955, but its intensity was found to be much lower in 1956. The 1955 and 1956 foliage has, for the most part, escaped attack. Some of the stands appeared slightly discolored in 1956 but close examination revealed that this was due to previous attacks on the 1954 and older foliage.

Spruce Needle Rust.—Evidence of this disease was very scarce during 1956. One small area of moderate infection was reported near Smith, but the heavy epidemics that occurred in 1955 over wide areas did not recur. The causal organism of this disorder, *Chrysomyxa ledicola* (Pk.) Lagerh., is thought to be quite dependent on weather conditions, particularly humidity. The past summer was relatively dry, perhaps accounting for the reduced incidence of the disease.

Winter Injury of Pine.—Otherwise known as red belt or winter drying, this disease was very prevalent throughout the foothills and mountain regions of western Alberta during 1956. A notable exception was the stands in the Robb-Coalspur area which showed severe discoloration after the winter of 1953-1954. The most conspicuous reddened areas were: south of the Kananaskis Forest Experiment Station in the Kananaskis Valley, many parts of the Athabaska Valley around Jasper Townsite, south of the Clearwater Ranger Station along the Eastern Rockies Forest Conservation Board Trunk Road, and in the Nordegg area.

PROVINCE OF BRITISH COLUMBIA

FOREST INSECT SURVEY

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INTRODUCTION

Forest Insect Survey activities in British Columbia in 1956 were continued to emphasize current infestations. The black-headed budworm infestation on northern Vancouver Island increased in extent and intensity. The 1-year-cycle spruce budworm outbreak in the Vancouver District decreased in intensity although the area infested increased in size. The 2-year-cycle spruce budworm caused heavy defoliation in the Babine Lake area. The Douglas-fir beetle was active in the Interior but the number of trees attacked in 1956 was considerably less than in 1955 and special surveys were conducted to determine the tree mortality.

The Victoria Laboratory received 2,158 insect collections, and the Vernon Sub-laboratory 2,208 for a total of 4,366. Of the total number, 245 collections were submitted by British Columbia Forest Service personnel, and 24 by other co-operators.

Collections received during 1956 were distributed among the principal tree species as follows:

Coniferous trees	Collections	
Hemlock—		
Western hemlock	1,164	
Mountain hemlock	8	
		1,172
Douglas fir		819
Spruce—		
White spruce	242	
Engelmann spruce	201	
Sitka spruce	130	
Black spruce	43	
Red spruce	4	
Miscellaneous spruces	4	
		624
Pine—		
Lodgepole pine	245	
Ponderosa pine	139	
Western white pine	75	
Miscellaneous pines	10	
		469
Fir—		
Alpine fir	239	
Amabilis fir	56	
Grand fir	51	
Miscellaneous fir	1	
		347
Cedar—		
Western red cedar	158	
Miscellaneous cedars	6	
		164

Broad-leaved trees	Collections	
Poplar—		
Trembling aspen	113	
Black cottonwood	35	
Miscellaneous poplars	13	
		161
Alder—		
Red alder	82	
Mountain alder	15	
Green alder	4	
Miscellaneous alders	17	
		118
Willow		98
Birch		33
Cherry		23
Garry oak		17
Maple		15
Arbutus		3
Miscellaneous broad-leaved trees		37
Total		505

Coniferous trees	Collections	
Larch—		
Western larch	86	
Miscellaneous larch	6	
		92
Juniper—		
Rocky mountain juniper	31	
Common juniper	2	
		33
Total		3,720
Miscellaneous hosts or no host specified		141
Grand Total		4,366

IMPORTANT INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.).—The 1-year-cycle spruce budworm infestation in the Lillooet River and Lake area spread southward from Pemberton as far as Tisdall, and northeast from D'Arcy along the Anderson and Seton lakes to Bridge River north of Lillooet. In the Fraser River Valley the outbreak in the Nahatlatch River Valley subsided, but heavy defoliation occurred in the upper Anderson River Valley. For aerial and ground surveys the infestation was classified as light, heavy, and very heavy. Areas where trees had been attacked for three or four years and which contained a large number of bare tops and twigs were classed as very heavy. Stands in which the characteristic red or light-red color caused by current defoliation predominated were classed as heavy and light respectively. The total infested area was 452 square miles, of which 30 were in the Anderson River Valley. (The final figure for 1955 was 379 square miles of which 82 were in the Fraser River area, rather than the 171 and 30 square miles respectively given in the 1955 Report.) Forty-one square miles were classified as very heavy and 96 square miles suffered heavy defoliation.

The most outstanding feature of the infestation this year was the recovery of the trees. Scattered top-killing was noticeable throughout the older outbreak areas, but was less than expected. Trees with up to five feet of bare terminal were commonly topped with a tuft of new foliage. In some areas practically all growth was from adventitious buds put out in 1954. In 1956 bud kill was negligible, and 68 per cent of the twigs suffered only light damage, a marked improvement over last year. In the hardest hit areas, only about one half of the trees previously thought to have no chance of survival are now expected to die.

Parasites ranged from 10 per cent in early larval collections to 59 per cent in late-instar collections. This latter figure represents an increase over 1955 but is based on a smaller number of larvae. Pupal parasitism, based on field-collected pupal cases, was 48 per cent, a small decrease from the 55 per cent of last year. The number of egg masses containing one or more parasites was 13 per cent, a drop of 14 per cent. No diseased larvae were found.

The number of eggs decreased considerably in localities where counts were high last year, while there was a general increase in areas which had had low-counts. The result was a more evenly distributed egg population. The highest egg counts were from sample points along Seton Lake, where 1956 was the first year of heavy defoliation. Egg counts in 1956 averaged 64 masses per 100 square feet of foliage compared with 112 in 1955, and 221 in 1954.

A 2-year-cycle spruce budworm infestation in the Prince Rupert Forest District was surveyed and mapped. The outbreak extended from Fulton Lake, Topley Landing on Babine Lake, and Tochcha Lake along both sides of Babine

Lake and the Nilkitkwa Lakes, up the Babine River as far as Kisgegas, and up the east side of the Nilkitkwa River to a point abreast of Centre Peak. Feeding was mostly restricted to spruce-alpine fir stands up to 3,000 feet elevation. The area was calculated to be 1,000 square miles. Defoliation was heavy, up to 100 per cent of the new foliage. Some of the 1955 and 1954 needles were lost in certain localities. Parasitism was very light. The egg population is high enough to result in medium to heavy bud damage in 1957.

The infestation on the lower end of Babine Lake in the area around Pinkut and Augier lakes persisted in 1956. At Pinkut Lake about 25 per cent of the buds were infested. The egg population was light.

The outbreaks at Star Lake and McKendrick Creek died out in 1956; no larvae were found and no defoliation was observed.

During 1956, the 2-year-cycle budworm population level in the Prince George Forest District decreased further. Defoliation was classed as a trace to light in most localities; obvious foliage discoloration was observed only at Lynx Creek north of Fort St. James, where defoliation was moderate. Budworms were slightly less numerous along the Hart Highway between Davie Lake and Pine Pass. The infestation in these areas covered some 35,000 acres of moderately defoliated alpine fir trees. Parasitism of larvae and pupae was very low. Egg counts indicate that the budworm population will be low in most parts of the Prince George Forest District in 1957.

In the Kamloops Forest District a light population of 2-year-cycle spruce budworm persisted in the subalpine forests of the Bolean Lake plateau and the Monashee Pass. Collections: Coast 133, Interior 86.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.—There was a decline in the Douglas-fir beetle population by the spring of 1956. At least some of the reduction was attributed to increased mortality of over-wintering stages. In the region about Lac La Hache, the number of beetles was reduced to one-third of the 1955 population level.

An intensive tree damage appraisal for the years 1953-55 was made in the summer and fall of 1956; the accompanying map shows the distribution of tree mortality caused by the Douglas-fir beetle in the province.

In the Nimpkish River Valley on Vancouver Island the number of green-attacked trees was small compared with the last three years. Felled and bucked logs were heavily attacked this year and undoubtedly absorbed many of the beetles. Company foresters in the area concerned estimate the total kill from 1952 to 1956 at 66,000,000 f.b.m., of which 19,000,000 f.b.m. have been salvaged. New attacks in the Lillooet River Valley, Vancouver Forest District, were also lighter than in 1955.

Mountain Pine Beetle, *Dendroctonus monticolae* Hopk.—In the Prince Rupert Forest District mountain pine beetle attacks extended from Morrison Lake along the east shore of Babine Lake to a point opposite Pierre Creek. Lodgepole stands on the west side of Babine Lake opposite Bear Island were also infested. There was a decrease in new attacks, but the outbreak is still active. In the majority of the trees examined the beetle attacks were pitched out. The volume of lodgepole pine killed in 1956 was calculated at 750,000 f.b.m.

The Takla Lake infestation in the Prince George Forest District also remained active in 1956. In southern British Columbia the population level was low.

Spruce Bark Beetles, *Dendroctonus* spp.—During 1956 no standing spruce trees were attacked in the infestation at Murphy Lake, Kamloops Forest District. The Engelmann spruce beetle continued its depredations in Nun, Monk, and Summit Creek valleys, Nelson Forest District. The large broods of larvae, pupae, and teneral adults in standing trees and freshly cut logs in Nun Creek Valley in September 1956, indicate that spruce bark beetles may be quite destructive in 1957. A tree damage appraisal showed that a total of 5,000,000 f.b.m. of spruce was killed by bark beetles in Nun, Monk, and Summit Creek valleys during 1953-55; 1956 damage was not determined.

Black-headed Budworm, *Acleris variana* (Fern.).—The black-headed budworm infestation on northern Vancouver Island increased in area and intensity in 1956. The known infestation, outlined by aerial and ground surveys, covered an area of about 3,000 square miles, an increase of nearly 1,400 square miles over last year. Some of this apparent increase is due to the extension of surveys into new localities. The entire northern end of the Island was infested as far south as Tahsish Inlet, Woss Lake, and Salmon River. Heavy defoliation extended over about 990 square miles in the following areas: Port Hardy to Holberg Inlet, Victoria Lake, Alice Lake, between Port McNeill and Englewood, and the Tsitika River Valley. In many cases the pole hemlock stands suffered heavy damage, and some mature stands lost up to 85 per cent of their foliage. The upper third of the crown was often the most heavily defoliated.

Larval parasitism averaged about 25 per cent, and pupal parasitism about 30 per cent. This was a considerable increase over 1955 when neither larval nor pupal parasitism exceeded 15 per cent in any area. Field sampling at the time of larval emergence indicated that egg parasitism was very low. No disease of any importance was found in the field.

An egg survey was conducted in the autumn of 1956 through the co-operation of various industries and the British Columbia Forest Service, who shared the expense and provided men to work with forest biology rangers. The results of this survey were not available at the time of writing but the highest egg counts were from areas where heavy defoliation occurred in 1956.

The same companies and the Forest Service also provided funds to conduct chemical control experiments in the Port McNeill-Port Hardy area during 1956. Ten per cent DDT in fuel oil applied at the rate of 1 gallon per acre gave good control. All larval stages from the second to the last instar were susceptible to the spray indicating that a control operation could extend over practically the entire period of larval development.

The infestation on the Queen Charlotte Islands has subsided. Hemlock stands at Cumshewa Inlet, Juskatla Inlet, Maude Island, Long Inlet, and Leonide Point in Skidegate Inlet sustained up to 90 per cent defoliation during the outbreak. Mortality plots have been established in several localities to study the effect of defoliation on tree survival.

Light to medium infestations were found along the coast from the Johnstone Strait Islands northward to Butedale. Light to medium defoliation was observed on hemlocks stands at Rivers Inlet, North and South Bentinck Arm, Labouchere Channel, and Elcho Harbour.

A light population of black-headed budworm persisted throughout much of the Interior but larvae were not numerous enough to cause noteworthy defoliation. The light infestation that has occurred on the Haines Road during recent years, subsided as did the severe outbreak along the Big Bend Highway. Collections: Coast 512, Interior 265.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst).—Hemlock looper numbers continued to decrease throughout the Province in 1956. No infestations were observed in the Interior.

In the coastal area occasional larvae were found in the Caycuse River, Nitinat River, Sarita River, and Harris Creek areas of southern Vancouver Island. Only a few larvae were collected in the other coastal districts. Collections: Coast 80, Interior 89.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Late in the summer of 1956, an infestation, in at least its second year, was discovered by P. Bodman of the British Columbia Forest Service at the north end of Adams Lake. Some 400 acres of trembling aspen trees had been severely defoliated by forest tent caterpillars. Egg counts averaging 37 masses per tree indicate that defoliation could be heavy again next year. Elsewhere in the Interior, the forest tent caterpillar was extremely scarce.

The forest tent caterpillar was found in association with the western tent caterpillar on the Saanich Peninsula, Vancouver Island. Although not in outbreak proportions, observations indicate that the population level is increasing. Collections: Coast 4, Interior 13.

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar).—The western tent caterpillar infestation in the Fraser River Valley has subsided. On the Saanich Peninsula, Vancouver Island, apple, alder, willow, and wild rose were heavily defoliated. Larval parasitism was 7 per cent, and pupal parasitism 49 per cent. Disease was present in late-instar larvae and caused considerable mortality in some localities. The population level is expected to decline in 1957. Collections: Coast 90, Interior 8.

Douglas-fir Needle Miner, *Contarinia* sp.—During 1956 Douglas-fir needle miner population levels decreased throughout the Province.

Some 30 to 50 per cent of the current year's needles were destroyed at Oyama, Westbank and Peachland. In the Nelson Forest District the miner was present in most of the southern portion of the District east to Kootenay Lake and north to McCulloch. In the vicinity of Cascade, Douglas-fir trees on approximately 100 square miles were severely attacked with up to 90 per cent of the current year's needles damaged. Trees with up to 50 per cent of the current year's needles infested occurred on the east side of Granby River about 11 miles north of Grand Forks.

On Vancouver Island, at Falls Park, about 15 per cent of the current needles of Douglas-fir trees were infested. Collections: Coast 4, Interior 200.

Silver-spotted Tiger Moth, *Halisidota argentata* Pack.—The silver-spotted tiger moth apparently disappeared from the southern portion of Vancouver Island in 1956. The cause of this disappearance is unknown as overwintering colonies were found late in 1955. In the northern part of the Island, there was a light to medium infestation from Lantzville north to Campbell River, and on the Strait Islands between these two points. Parasites killed 32 per cent of the larvae reared. Collections: Coast 13.

Fall Webworm, *Hyphantria cunea* (Drury).—The unsightly tents of this webworm were numerous in the Okanagan Valley and the lowlands about Kamloops and Shuswap lakes. Collections: Interior 8.

A Hemlock Sawfly, *Neodiprion* sp.—The sawfly on hemlock remained prevalent in the Nelson and the eastern part of Kamloops Forest districts. It was less numerous along the Big Bend Highway than it was in 1955; defoliation ranged from a trace to light. Hemlock stands around Holberg Inlet, northern Vancouver Island, sustained light to medium defoliation in 1956. Collections: Coast 239, Interior 120.

A Douglas-fir Sawfly, *Neodiprion* sp.—Light to medium defoliation of the new growth of Douglas-fir trees was observed over 4 acres near Larkin, and 3 acres near Squilax. The most severe defoliation was at Larkin where 60 to 100 per cent of the new needles in the upper third of the trees were eaten. No sawfly eggs were found indicating that the outbreak may have collapsed. Larvae were collected in small numbers on northern Vancouver Island. Collections: Coast 59, Interior 163.

Satin Moth, *Stilpnotia salicis* (L.).—There was a decline in the abundance of the satin moth in the Bestwick and Lac du Bois areas in 1956. Tree mortality occurred in at least one of the trembling aspen groves that had been repeatedly defoliated.

A DDT spray applied in June 1956, apparently controlled the small infestation of satin moths at Kinsmen Beach, near Okanagan Landing.

Silver poplar trees at Victoria, Comox, Courtenay, and Genoa Bay, all on Vancouver Island, were again heavily defoliated. Parasites killed about 19 per cent of the larvae reared. Collections Coast 15, Interior 8.

Douglas-fir Tussock Moth, *Hemerocampa pseudotsugata* McD.—No larvae were observed near Cascade where an infestation occurred in 1955. A medium infestation persisted at Olalla during the spring of 1956. but disease caused an almost complete collapse by the end of the larval stage. Tussock moth larvae were collected in small numbers on Long Mountain near Oyama, at Yellow Lake, Bridge River, Lillooet and Lytton. Collections: Interior 18.

Phantom Hemlock Looper, *Nepytia phantasmaria* (Stkr.).—Two localized outbreaks of the phantom hemlock looper occurred in the Vancouver Forest District in 1956. About 200 acres of wooded area in Central Park, Burnaby, were heavily attacked. The top 20 feet of the crowns of some hemlock trees were completely stripped, and all crowns were heavily defoliated. The area was sprayed on August 3 with a 10 per cent solution of DDT in No. 1 fuel oil with good results. About 80 per cent of the mature hemlock trees and three small red cedar trees in the northwest corner of Queen's Park, New Westminster, were completely defoliated. There was a high incidence of a polyhedral virus in the specimens collected from the latter area. Collections: Coast 42.

Larch Sawfly, *Pristiphora erichsonii* (Htg.).—The larch sawfly remained scarce. A few individuals were collected near Phoenix, in the western part of Nelson Forest District. Only one colony was observed in the Prince George Forest District.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch).—Heavy tree mortality has been caused by this scale insect among ponderosa pines bordering fruit orchards in the following areas of the Okanagan Valley: Campbell Mountain south of Skaha Lake, east of Oliver, and on the east side of the Valley from Duck Lake north to Oyama. The scale *Nuculaspis californica* Coleman replaces *Phenacaspis* in the southern parts of the Okanagan Valley.

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.—Young Engelmann spruce trees were lightly infested by *Pissodes* at various places in the Nelson Forest District, including localities along the Monashee Highway and near Salmo. At a sample point along the Upper Kettle River, 27 per cent of the trees were infested in 1956, and 40 per cent had been infested in previous years.

Damage by this weevil was apparent on open-grown white spruce reproduction in the Prince Rupert Forest District. In an old field near Sheraton Station, 19 of 72 white spruce trees were infested this year.

A Pine Root Weevil, *Hylobius* sp.—Weevils were common throughout the white pine stands of the central portion of Nelson Forest District. Weevils were taken south of Kaslo, near Revelstoke, and along Kushanax Creek. At Kushanax Creek some small dead or dying white pine trees showed evidence of *Hylobius* feeding.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.).—This defoliator was numerous in some parts of the Prince George Forest District; the most severe defoliation, averaging 50 per cent, extended for 15 miles along the Hart Highway north of Salmon River. Collections: Interior 6.

Aspen Leaf Miner, *Phyllocnistis populiella* Cham.—The aspen leaf miner was again abundant over much of the range of trembling aspen in the Interior, north into Yukon Territory.

In the Prince Rupert Forest District heavy infestations occurred north and east of Cedarvale, along the Skeena River Valley above and below Hazelton, and between Hazelton and Smithers. Up to 100 per cent of the foliage was infested. Collections: Coast 8, Interior 21.

Willow Leaf-miner, *Lyonetia saliciella* Busck.—This miner was again abundant on willow in the western and central portions of the Nelson Forest District.

Striped Alder Sawfly, *Hemichroa crocea* (Fourc.).—An infestation extended over a 105-square-mile area in the Vancouver Forest District. Areas affected were Port Moody, Port Coquitlam, Ives Lake, Buntzen Lake, and Mt. Seymour. Feeding by the first-generation larvae was heavy around Port Moody, but all areas were attacked by larvae of the second generation. Much of the red alder was completely defoliated.

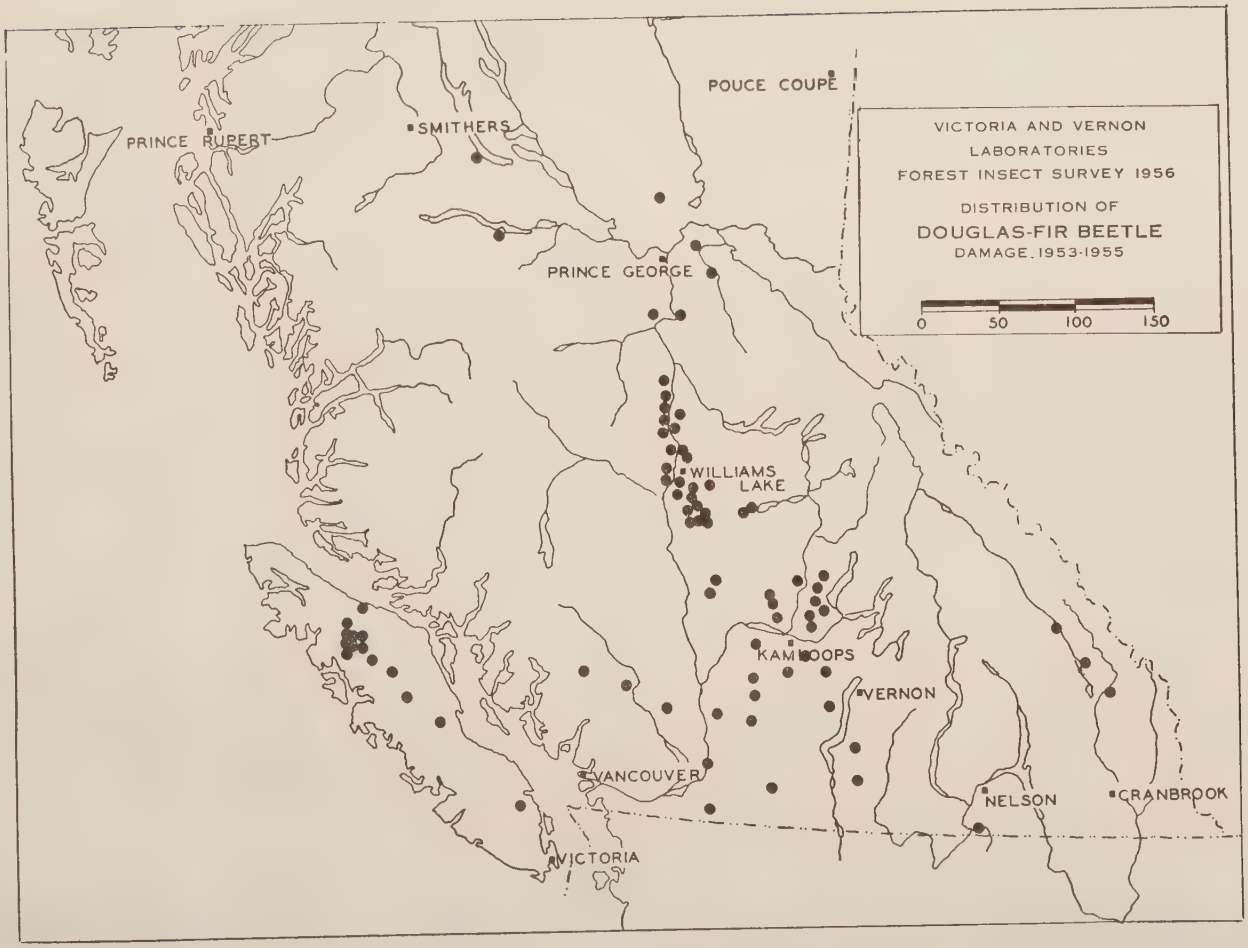
In the Interior, most of the mountain alders along the west arm of Kootenay Lake were defoliated. Collections: Coast 20, Interior 3.

Spruce Gall Aphid, *Adelges cooleyi* Gill.—Spruce regeneration from the east end of Francois Lake to Endako, Prince Rupert Forest District, was heavily attacked by spruce gall aphids. In some areas up to 60 per cent of the new twigs had galls.

Spruce Seed Moth, *Laspeyresia youngana* Kearf.—In the Yukon Territory the spruce seed moth and a dipteron caused severe damage to white spruce seed. Samples taken in some 300 square miles of forest indicated that 45 to 95 per cent of the spruce cones were infested.

White Pine Cone Beetle, *Conophthorus monticolae* Hopk.—An estimated 60 per cent of the western white pine cones along Crawford Creek, on the east side of Kootenay Lake were infested by this beetle.

A Poplar Flea Beetle, *Altica* sp.—The foliage of cottonwoods bordering the Kootenay River between Wasa and Newgate appeared scorched from flea beetle feeding.


VICTORIA AND VERNON
LABORATORIES
FOREST INSECT SURVEY 1956
DISTRIBUTION OF
DOUGLAS-FIR BEETLE
DAMAGE, 1953-1955
0
50
100
150
POUCE COUPE
PRINCE RUPERT
SMITHERS
PRINCE GEORGE
WILLIAMS LAKE
KAMLOOPS
VERNON
VANCOUVER
NELSON
CRANBROOK
VICTORIA

PROVINCE OF BRITISH COLUMBIA

FOREST DISEASE SURVEY

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INTRODUCTION

Forest disease conditions during 1956 featured a marked reduction in the intensity of foliage diseases. This tendency was particularly well demonstrated by the status of needle rusts which were little in evidence despite a very high level of infection during the summer of 1955.

The unusually severe winter of 1955-56 brought reports of winter damage from many regions. Early frost damage to yellow pine was particularly noteworthy. Apparently affected before dormancy by a sudden drop in temperature in early November, this species sustained widespread and severe foliage mortality. Many exotic ornamentals were killed, particularly in southern Vancouver Island and lower mainland areas.

An aerial and ground survey of winter-damaged Douglas fir was carried out during the summer of 1956 in the Cariboo region. Stands examined had suffered varying degrees of damage as the result of the extremely low winter temperatures of 1952-53 and attack by the Douglas fir bark beetle, *Dendroctonus pseudotsugae* Hopk. Reports of extensive mortality indicated a potential salvage problem and prompted a request for a complete investigation of the pathological condition of the affected stands. The survey was carried out to meet this request.

A canker and dieback disease of Douglas fir, previously reported as having a sporadic occurrence, reached epiphytotic proportions in some areas during the past spring and summer. The nature of the sudden build-up suggests climatic influences.

The task of cataloguing and maintaining observations on plantations of introduced trees was begun in 1956. This project is intended to provide a check against the spread of potentially dangerous non-indigenous forest diseases and an evaluation of the effects of native diseases on introduced trees. Agencies concerned with the introduction of exotic trees for plantation purposes were requested to report the establishment of plantations to the Survey Officer, Forest Pathology Unit, 409 Federal Building, Victoria, so that new plantations might be registered and kept under observation.

A check list and host index of the Victoria Mycological Herbarium has been completed and brought up to date and the Herbarium has recently been listed in the Index Herbariorum, Utrecht, Netherlands.

Grateful acknowledgment is hereby tendered to the many co-operators who have submitted samples and reports during the past year. The Mycology Unit, Botany and Plant Pathology Division, has continued to render valuable identification service to the Survey.

The emphasis placed on decay fungi and the Douglas fir dieback problem during 1956, required nearly 90 per cent of the 5074 collections to be examined in culture. The collections were derived from the principal host trees as follows:

Coniferous trees	Collections	
Douglas fir		2,051
Fir—		
Alpine	1,026	
Amabilis	7	
Grand	5	
		1,039
Pine—		
Ponderosa	726	
Lodgepole	25	
Western white	10	
Red	5	
Scots	3	
		769
Spruce—		
White	565	
Sitka	33	
Engelmann	14	
Black	3	
		615
Cedar—		
Western red	195	
Yellow	1	
		196
Larch—		
Western	56	
Alpine	3	
		59
Hemlock—		
Western	28	
Mountain	1	
		29
Juniper, Rocky mountain		7
Cypress, Monterey		5
Yew, western		1
Total		4,771

Broad-leaved trees	Collections
Willow	26
Alder, red	17
Aspen, trembling	14
Birch, western white	7
Cottonwood, black	5
Apple, Pacific crab	3
Oak, Garry	3
Dogwood, western flowering	1
Maple, vine	1
Total	77

Miscellaneous or host not specified	226
Grand Total	5,074

IMPORTANT DISEASES

Decay and Post-felling Deterioration of Interior Douglas Fir and Yellow Pine.—Sampling was resumed in 1956 on volume and decay analysis plots established by the British Columbia Forest Service. This work involved studies to determine the fungi responsible for decay before felling as well as those responsible for post-felling deterioration. Sample plots were classified as to site, using a plant indicator method so that the influence of forest habitat on decay and deterioration could be assessed.

A total of 514 fir and 266 pine trees were sampled in 21 areas throughout the Douglas fir—yellow pine region as far north as Kamloops. Further analysis of data and completion of cultural identifications are required before the results of this survey are fully known. However, an interesting trend was noted on the basis of field observations and limited examinations of data to the effect that yellow pine sapwood deteriorates much more rapidly than that of Douglas fir. Average radial depth of penetration in Douglas fir, 3 years after felling, was about 1 inch while that for yellow pine was nearly three times as great. This trend is considered significant for it was consistent in all areas.

Canker and Dieback of Douglas Fir.—A canker and dieback of Douglas fir, which has been reported from time to time as causing negligible damage, assumed outbreak proportions in 1956. Both natural and planted stands up to 30 years of age were affected generally throughout the range of Douglas fir on Vancouver Island and the adjacent mainland.

The disease is readily recognized by the occurrence of leader and branch flags resulting from a dieback condition beginning at or near the terminals. In addition cankers are produced, occurring anywhere on the branches and stems. The extent of the dieback varies from a few inches to several feet, often involving several internodes. The cankers vary in size from less than 1 inch to almost 12 inches in length but rarely cause girdling. Needles are cast from most of the affected branches by mid-summer. These dead sticks remain quite conspicuous against the background of normal foliage.

Preliminary surveys showed damage to range from mortality to various degrees of deformation. Mortality in the current year appeared light, although it was as high as 15 per cent in some areas. Incidence of infection ranged from 0 to 85 per cent. Since much of the disease remained active without apparent callusing during the summer, accurate damage appraisal will require further observations. Early indications are that the damage was most severe on below-average sites.

Although the cause of the damage has not been definitely established early indications are that at least two fungi are involved. Both these fungi will require testing for pathogenicity. A species of *Pullularia* was found closely associated with the dieback and some of the cankering. Another fungus, producing a cream colored coremium in its imperfect stage, was consistently associated with the remaining cankers which were distinct as to size, shape, and coloration.

Winter-Damaged Douglas Fir in Interior British Columbia.—A large portion of the Cariboo District of British Columbia was subjected to extremely low temperatures during the winter of 1952-53 and subsequent attack by the Douglas fir bark beetle *Dendroctonus pseudotsugae* Hopk. As a result, extensive areas of Douglas fir were damaged to varying degrees. A satisfactory level of recovery was observed in some of the areas involved but considerable mortality was reported to have occurred in others. The extent of mortality reported indicated that a salvage problem of considerable magnitude existed and prompted a request for an investigation into the pathological condition of Douglas fir in the district concerned.

An aerial survey of the district and ground surveys of a limited number of areas were carried out during the summer of 1956 and substantiated the existence of extensive areas of mortality. It became evident that although some mortality could be traced to the initial damage of 1952-53 additional killing had occurred and was continuing subsequent to that date. The extensive killing that had already taken place justified a more complete investigation than was possible during the initial appraisal. Therefore, a detailed investigation was initiated later in the summer.

Frost Damage to Yellow Pine.—Severe and widespread killing of yellow pine foliage was attributed to a sudden drop in temperature early in November, 1955. Damage first became apparent in early spring. Ground and aerial surveys made later in the year showed the region of severe damage to extend from Princeton to a point 10 miles north of Merritt; the Thalia, Brookmere, and Alleyne Lake areas being the most heavily damaged. One or two other small centers of damage were noted but in general the Merritt-Princeton region was the only major area to give cause for concern.

Damage was confined to the foliage, the buds and young twigs being generally uninjured. The percentage of foliage killed was quite variable in trees within the same stand, ranging from 0 to 100 per cent. When only part of the needles were killed, the older needles were most severely affected. Mortality was much less than early summer observations indicated for only a few trees of previously low vigor died. Should a severe winter occur in 1956-57 further mortality might occur, for many of the defoliated trees have been badly weakened.

In order to evaluate the results of this winter damage 15 sample plots including 520 trees were established. The British Columbia Forest Service and the Forest Zoology Unit co-operated in this project. Trees ranging from reproduction to overmature were tagged and described according to degree of defoliation and Keen's age-vigor classes. Spring and fall examinations are planned until the stands appear to have returned to normal. Finally radial increment will be measured to determine the effect of defoliation on growth.

Plantations of Non-indigenous Trees.—A beginning was made in cataloguing all plantations of exotic tree species in British Columbia and in maintaining a record of their pathological condition. The project was initiated to check against the spread of foreign disease and to evaluate the effects of native diseases on the introduced trees.

The 1956 program consisted primarily of locating plantations and gathering general information as to their condition and the problems involved in their regular examination. A total of 38 European and non-indigenous North American tree species have been recorded from 57 plantations. These are all located on Vancouver Island and the lower mainland coast. Aside from a few plantations established between 1930 and 1940 all existing plantations are under 10 years old and over 50 per cent of them are under 4 years old.

From general observations in 1956 the main difficulties in young plantations are competition from naturally occurring trees and brush, animal browsing, and poor adaptation to site. The role of disease is not yet clear, for the identity of causal factors is obscured. Regular annual examinations will, however, provide a clearer picture. Evidence of disease activity was more readily recognized in older plantations. A 26-year-old lodgepole pine plantation, very poorly adapted to its present site, was severely damaged by a number of diseases and at least one insect. The combined infection by a blister rust *Cronartium coleosporioides* Arth. var. *stalactiforme* (A. & K.) Arth. and a canker caused by *Atropellis piniphila* (Weir) Lohman and Cash resulted in severe deformation to 28 per cent of the stems. The major portion of early mortality in the stand was apparently caused by the rust. A pitch moth, *Vespamima sequoiae* Hy. Edw. was found infesting 58 per cent of the trees. Root rot caused by *Armillaria mellea* (Vahl ex Fr.) Quél. was common in trees of poor vigor.

Disease Conditions in Forest Nurseries.—In 1956, post-emergence damping-off was very light at the Campbell River and Green Timbers nurseries, and moderate at the Duncan and Cranbrook nurseries.

At Cranbrook, some of the yellow pine seed used was several years old and required a heavy rate of sowing. In a fungicide test bed, using some of this old seed, some of the fungicides tested increased emergence by 75 to 200 per cent as compared with the control. This would indicate that pre-emergence damping-off is a factor in some parts of this nursery. The old seed appears to be more susceptible to pre-emergence damping-off probably because of its much slower emergence.

OTHER NOTEWORTHY DISEASES

(V.I.—Vancouver Island; Q.C.I.—Queen Charlotte Islands)

Host	Organism	Locality	Remarks
Alder, red	*Eutypella stellulata* (Fr.) Sacc.	Saanich, V.I.	Associated with dieback of the branches of a living tree. First herbarium record.
Alder	*Eutypa* sp.	Courtenay, V.I.	Associated with dieback of alder. First herbarium record.
	Tympanis alnea (Pers.) Fr. var. *hysterioides* Kehm.	Prince George	Associated with dieback of alder. First herbarium record.
Birch, western white	*Melampsoridium betulinum* (Fr.) Kleb.	Lumby and New Denver	A leaf rust disease, locally abundant. First host record for Canada.
	Naematoloma fasciculare (Huds. ex Fr.) Karst.	Aleza Lake	Associated with trunk decay. First herbarium host record.
Hemlock, mountain	*Hericium* sp.	Copper Canyon	Causing white pitted decay. New host record of an undescribed species.
Huckleberry, red	*Chrysomyxa ledi* de Bary var. *vaccinii* Ziller	Qualicum Beach, V.I. and Masset, Q.C.I.	A newly discovered and recently described variety of foliage rust disease. (The alternate state of this rust, although still unknown, probably causes a needle cast of spruce.) Ref.: Can. J. Bot. 33: 492-493. 1955.
Pine, Scots	*Peridermium* sp.	Powell River, V.I.	In a plantation of exotic conifers. Single tree infected with an unidentified species of blister rust.
Spruce, white	*Coccophacidium* sp.	Aleza Lake	Associated with dieback. No species of *Coccophacidium* previously reported on spruce.
	Polyporus schweinitzii Fr.	Prince George	Causing root- and butt-rot. First herbarium record, previously isolated in culture.
	Xeromphalina campanella (Batsch ex Fr.) Kühner & Maire	Prince George	Associated with decay of slash. First herbarium record, previously isolated in culture.
Spruce, white and black	*Chrysomyxa pirolata* Wint. (=*C. pyrolae* (D.C.) Rostr.)	Prince George	Spruce cone rust; locally epiphytotic near Stone Creek and Tabor Mt. Ref.: Annu. Rept. For. Ins. Dis. Surv. for 1951: 151.

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